

# AUTOMOTIVE INDUSTRIES

## The AUTOMOBILE

Vol. XI  
Number 8

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PUBLISHED WEEKLY AT 239 WEST 39th STREET  
NEW YORK, FEBRUARY 20, 1919

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**Hudson Motor Car Company**  
**Detroit, Michigan**

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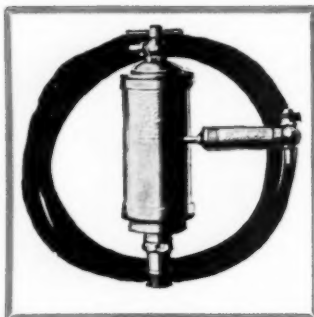
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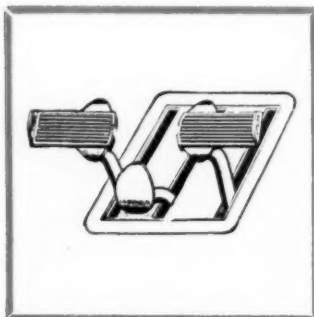
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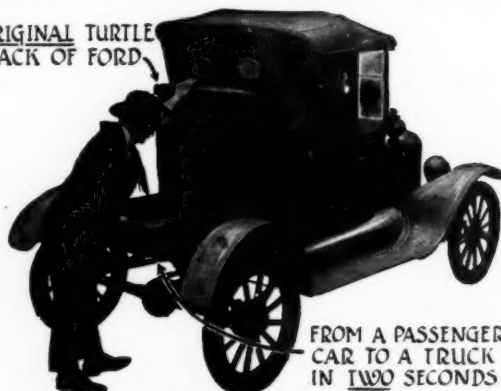


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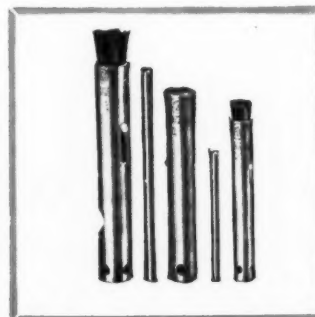
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# AUTOMOTIVE INDUSTRIES

## The AUTOMOBILE

VOL. XL

NEW YORK—THURSDAY, FEBRUARY 20, 1919—CHICAGO

No. 8

## European Expansion Under War Pressure

Manufacturers Unprepared for Peace Conversion—Merchandising Organizations Disrupted—Government Financing and Designing Ended with Armistice—Knowledge of Production, But Without Design and Finance

### PART II

By David Beecroft

LONDON, England, Jan. 21—It is not surprising that after 4½ years of war many of the British and Continental manufacturers find themselves unprepared for quick conversion onto a peace basis. Some of these factory organizations resemble a person who has unexpectedly been knocked down by a vehicle whose approach was not noticed. While in this predicament the first impulse is for help and protection. So with these factories; not having the future clearly mapped out and having during the war suffered a complete destruction of its entire merchandising organization, the first impulse is a negative as contrasted with a positive course.

The reason for this is quite fundamental.

One manufacturing magnate has said that successful business is made up of four cardinal activities: a—designing, b—production, c—financing, d—merchandising. The correct proportioning and synchronizing of these four is the essential of success. With the British makers during 4 to 5 years of war only one of these four has received attention, namely, production. But not so with designing.

The Government has looked after that; at least it has been done by some one outside of the factory in which the job was manufactured and the factory owner has had all the finance handled for him. The Government has handled it. He has never had to give scarcely a moment's consideration to it. So with merchandising. The Government has been the only customer, and selling and production have become as inactive as designing and financing the job.

Thus has the British manufacturer largely, under war, gone through a spoon-feeding production. He has seen his factory double, triple, quadruple and in some cases, increase tenfold. He has seen unheard of increases in production and he has for four to five years watched almost the complete disintegration of his selling organization both at home and abroad.

Thus we see these manufacturers to-day having to take up three activities which from four to five years have been crippled by the Government. It is not to be wondered that after the thunderbolt at noonday of November 11 a period of indecision

should set in and that with Christmas days ahead that indecision should prolong itself, with elections aiding in this delay.

This may explain why five post-war models are ready, why five post-war model prices had been set and why plans for the future are not crystallized as many might expect. But while picking up the three activities of design, finance and merchandising, which had remained dormant during the war, is a task of no mean magnitude, the British maker is confronted with other problems that are giving him perhaps greater concern. To-day he finds himself at the forks in the road. To his right lies the new highway for increased production, which looms into new importance because of the large modern factories filled with modern machinery that he finds himself in possession of as a result of the war.

To the left is the long trodden and more familiar road of low production and high price of the article coupled with wide variation in design, multiplicity of models and old design developed as a result of low production methods.

Which course to select is a problem of marked stature to the maker, who is yet hedged round with the smoke of battle and the never-ending demand of daily increasing production of munitions of war.

### Must Change Manufacture Radically

To decide as to which fork in the road to take is made harder by the withdrawal of the strong arm of the Government. From now on the factory must carry along all four activities, design, production, finance and merchandising. Many factories had not sufficiently weighed each of the four. Some are weak-hearted. They want to go into quantity production but are weak-kneed. They are afraid they cannot merchandise them. Their old selling prices are gone. New ones had to be built up and 4 years of war has entirely eliminated the merchandising factor and it will be hard to rebuild.

Design for quantity production is a stumbling block to many. From 4 to 5 years their engineers in some cases had been on special war work, and they had not followed very closely what has been done. It is not surprising when thus halting at the fork in the road and in the throes of such a mental chaos that positive action should seem slow, if not naturally wanting and that the negative action should seem to dominate with not a few concerns.

To enter whole-heartedly into quantity production called for a radical change in British motor car manufacturing methods. It calls for a complete discontinuance of the old method of pre-war days—those days of Olympia expositions when the maker took to Olympia his new model to see how it caught the public eye and to see how many orders he could get, how much deposit money he could bring home and so, when the show was over, completely revise and design the job and start manufacturing. That was a sure-game policy. There was no losing on it. But that was not quantity production. It did not contain a single fundamental of quantity production.

### Bold Program Needed

A few of these same sure-game managers are in charge of factories. True the factories are new. True they are modern factories. True the Ministry of Munitions has had production in them, but this does not insure a quantity production program in car manufacturing.

Quantity production calls for a bolder program than the average British manufacturer has attempted in the past. It calls for a complete reversal of attack. It presupposes a mental change as well as changes in manufacturing processes.

The question of the moment is can the British maker convert himself to the new quantity program?

### British Factories Ideally Equipped

Notwithstanding the handicaps which the British manufacturer is under because of the war, he has the advantage of greatly increased factors. These invariably are of the very last word in modern construction, and are permanent, as everything of the kind is in Great Britain. Buildings are invariably brick, generally of the one-story type with saw-tooth roof construction, and have very large rooms. Everything necessary in the way of good lighting, good arrangement of machinery, central heating, forced ventilation, canteens at which the great majority of employees can get cheap noon-day meals, Red Cross facilities, with resident doctor and corps of nurses, auditoriums for entertainments, technical libraries, educational classes, in fact everything that could be asked for in connection with British factories exists.

While many of these additions are recent, not a few of them were made about the middle of the war, so that the companies have been using these factories at capacity for two years, and in some cases longer.

Rolls-Royce is a typical example of British factory expansion under the war. This factory has been required to manufacture only aircraft engines. Before the war it had 3000 employees and on Nov. 11 it had 8000. The factory covered 11 acres. The new buildings were erected on an orderly basis, and were filled with the finest machinery possible to obtain. When the armistice was signed the company was producing upward of 80 aircraft engines per week, mostly of the Eagle and Falcon models. It had started production on the large Condor twelve-cylinder type with cylinders 6½ by 7½.

Such a firm had little opportunity of making any progress on its post-war models because of Government control, and it will be engaged on aircraft work for some months to come. Its post-war program consists largely of carrying on its pre-war model, the 40-50-hp. six-cylinder chassis. There are many rumors of a small six-cylinder chassis of 15.9 hp., but these could not be confirmed.

### Increased Organization Nearly 1000 Per Cent

One of the companies to make perhaps unprecedented progress during the war is Austin of Birmingham, which previous to July, 1914, had 2500 employees, but now has 22,000, or had this number on armistice day. The factory buildings are situated well in the country in Northfield, which is a suburb of Birmingham. This company during the war has had a variety of activities. It delivered 2000 airplanes, 2000 motor trucks, 350 armored cars, 650 guns, 750 touring cars, 148 ambulances, but by far its greatest reputation was made in its shell manufacture. In this work it reduced the price of the 9.5-in. shell from approximately \$62.50 to \$31. In other words, it cut it in half. The reduction in cost was of such importance that the matter was brought up in Parliament and an explanation of how it was possible to accomplish such results was made. Being located in the country it has been necessary for the Austin company to have special trains to bring its 22,000 workers from the surrounding locality. The railroads carried 10,500 of these workers to the plant in a period of 85 min. The company

has lines of motor buses which cover many of the adjacent areas.

Factory buildings cover 53 acres, and it has been necessary to feed 20,000 of the workers at the factory. This has called for a tremendous canteen organization.

Austin was one of the few companies fortunate in being able to develop its post-war model.

### Maintains Technical Institute for Employees

This factory literally abounds with activities for the benefit of the workers. There is a technical society with a membership of 750 which holds regular meetings and has a technical library of over 500 volumes. The company has accommodation for 10,000 bicycles used by its employees. There is a large factory farm on which much of the produce for the canteen was grown. At a company grocery store it has been possible to supply provisions at a low price which were difficult to obtain. There is a technical institute for the education of the factory apprentices, who are given time during their working hours to take educational courses.

Another British factory which can be looked upon very largely as a war plant is the Siddeley at Coventry. On armistice day this factory was employing 5000 to 6000 workers and had 20 acres of floor space. It was delivering 150 airplane engines per week and twenty complete planes. With each of these went a 50 per cent stock of spares, which gave a considerable war output. The Siddeley factory is as modern a plant as could be found. The buildings are all of brick construction, largely one-story design, with a few multi-story buildings. Light, heating and ventilation are the best that can be found in any country. All buildings are fitted with modern machinery, much of which is American. The Siddeley company gives promise of being one of the aggressive British manufacturers in car production, and, while the company's plans are not definitely worked out, it has two thoughts primarily in mind—first, the production of a good car in quantity, and second, the merchandising of it at a low price.

### Continue to Build Aircraft Engines

This company, like other British companies, has had great experience in manufacturing aircraft engines. It was one of the first to manufacture the twelve-cylinder air-cooled V-type R.A.F. which has had such wide use in the Royal Air Force. Siddeley took the drawings of this engine in December, 1914, and had the first engine made in March, 1915. In addition to manufacturing this engine, Siddeley has manufactured his own vertical six-cylinder design. It is stated that 25 per cent of all the British engines at the front were made by the Siddeley company. The Lanchester firm, one of the pioneers in Great Britain, has been engaged almost exclusively on aircraft production. It has been manufacturing the Arab Sunbeam model, an eight-cylinder design which has been produced in great quantities. In addition Lanchester has built other aircraft engines and expects to be engaged on this work for many months yet. During the war it built many of the air-cooled R.A.F. types.

The Sunbeam company was required by the Government to devote all of its attention during the war to the development and production of aircraft engines, and although the Sunbeam automobile was used as a staff car, the company was not permitted to build it in order that all of its activity might be devoted to aircraft work. Previous to 1914 the Sunbeam company had gone perhaps as far as any British concern in the development of aircraft engines, and it was because of this preliminary work that the Government practically assumed complete

direction of the factory. Since the starting of the war 27 different types of aircraft engines have been developed for various uses, such as airplanes, seaplanes, blimps, dirigibles, flying boats, etc. Several of these engine types have been developed for certain types of machines, such as the flying boat for Russia. The company has 4000 workers, and has capacity for 4000 automobiles per year or approximately 80 per week. The factory has not developed as extensively as many other factories during the war largely because it has been used more as a development factory than a production one.

Vauxhall is another company that has made great development during the war, and many factory additions have taken place. The company is relatively small, with 1800 workers at the end of the war. It was largely engaged on the manufacture of Vauxhall cars throughout the war and so suffered very little disorganization. Because of this the company was able to develop its new four-cylinder valve-in-the-head car, which is one of the few British post-war models. The company does not contemplate going ahead rapidly on this model, which is designated as the 30-98 type, and plans only 50 of them for this year. It has a speed of 80 to 90 m.p.h. on the level, and travels 25 miles to the gallon at 33 m.p.h. with a four-seated body which weighs 2464 lb. The cylinders are 98 x 150 millimeters.

L. H. Pomeroy, the Vauxhall engineer, shares with many British engineers the opinion that designing an airplane engine is child's play compared with the automobile line. Many of them think that one Grand Prize road race gives them more information on engines than four years of war.

### Crossley Output 250 Cars Monthly

The Crossley is a typical example of the growth under war pressure of one of the old British manufacturers. Before the war it had 500 employees, and on Nov. 11 it had 5000. Its capacity of fifty cars per week before the war has increased to 250 per week now. Before the war the old factory had 2½ acres of floor space and now it is 9 acres. In addition the company has one of the largest aircraft factories in England, which was completed about the middle of 1918. It covers 23 acres and is located in the outskirts of Manchester, or approximately 3 miles from the old factory. The erection of this factory was one of the building accomplishments of the war. In December the company was devoting one-third of its manufacturing effort in its old factory to airplane engines and two-thirds to motor cars. Two types of engines were in production, the six-cylinder Beardmore and the British air-cooled B.R. 2, a rotary type of engine. Just before the armistice the factory started on the manufacture of a third type of aircraft engine.

In the early days of the war—in fact, as far back as 1912, when the British Government organized the Royal Flying Corps, which later became the Royal Air Force—it was decided to use the Crossley chassis as the motor vehicle best suited for a good deal of the aircraft work, and when war broke out 100 of these were ready for the work. This was followed by Government orders to produce as many as possible. In the early days of the war these were produced at the rate of 30 per month and in the final days at 250 per month.

### Made Tractors, Guns, Trucks, Airplane Engines

Renault, for example, has been manufacturing his heavy tractors for moving guns; he has been manufacturing cars; he developed the small Renault tank, and was producing it at the rate of 20 per day in December; he was manufacturing large guns com-

plete; he was manufacturing motor truck types of axles and running gears for guns; he had built an entirely new aircraft factory for the manufacture of planes; and he was manufacturing different types of aircraft engines.

With all this variety of war program it was quite impossible to install modern production methods on each and all. Notwithstanding this he had in operation one of the best systems of aircraft assembly in Europe. He was assembling the small tanks on a production progressive assembly basis, using the traveling chain method.

These tanks were traveling steadily along an assembly platform and the work on them was being carried on as they progressed. The war had required the opening up of new foundries which were constantly enlarged from time to time. So it was with all the other departments of the factory. There was never any time when each had reached its state of completion. It was a constant program of expansion, with no thought of terminating it until the morning of Nov. 11.

### No Halt to Expansion

The development in other French factories was on a par. The case in question is that of the Gnome company manufacturing the Gnome and LaRhône engines in Paris. This company, previous to the war, had 500 employees. In December it was working with 4,000. The entire force was on aviation engines.

The company was producing thirty-five per day and was building four models of the Gnome alone. It had been asked by the government to build 350 of the Salmson radial type engine which has been such a successful war product.

The company has two large Paris factories and had partly completed a large foundry, part of which was in operation and had just completed the building for a very large forge shop. Some of the hammers had just been moved into the building and the work of installation was just started.

In the design and layout of these new buildings there was only the thought that the government must have more engines from this company no matter what the cost or what the possibilities of using these factories should the war unexpectedly stop. The work of equipping them was going ahead in December. Besides this, great additions to the factories for machine shops and assembly rooms were in the course of erection. The factory is a fine brick structure modern to the last chapter of factory design and equipped with all the modern machinery that aircraft engine manufacture called for. The company had manufactured many of its own lathes which were in use. Long rows of American machinery were seen alongside of French, British and Italian machinery.

### 800 Aviation Engines a Month

The company was going ahead on a war program developing its 800 hp. twenty-cylinder radial type engine, with fixed cylinders as compared with the rotary type engine which this company has always manufactured. The fixed cylinders were arranged in four circles of five cylinders to the circle. The circles were placed one behind the other so that each group of five cylinders was working on a single throw of the crankshaft. The job is water-cooled which represented a new departure in Gnome practice. Also under development was the new 500 hp. Salmson radial engine which the company was aiding in the development of at the request of the government.

Another French firm, Lorraine-Dietrich, made amaz-

ing development during the war. Its factory area has been more than doubled and it has been producing aviation engines at the rate of 800 per month. This is one of the old French automobile concerns which very early began the development of aircraft engines and which is to-day looking into the future and preparing for the possibilities of commercial aviation. Its factory additions have been carried out on a broad practical basis rather than in a step by step piecemeal topsy-turvy way.

The factory has enormously large rooms for machine shops, assembly, etc. They compare with the largest manufacturing floors in America. The machinery is all laid out in a well organized way, but there is a lack of electric industrial trucks to facilitate in removal of the material. The company is one example of the many that have endeavored to secure such equipment during the last year or two.

This company has been carrying through a large airplane program and its final thought is indicated in the development of a twenty-four-cylinder, 1000 hp. W-type of engine that should be well suited for commercial work. There are three rows of cylinders, the center row mounted vertically, and a row at each side, inclined slightly above the horizontal. All three groups work on the one crankshaft. The company has been producing an eight-cylinder V-shape 275 hp. with cylinders mounted at 90 deg. It has also been producing a twelve-cylinder 400 hp. type with cylinders at 60 deg. and a twelve-cylinder 600 hp. type with cylinders at 60 deg. The 600 hp. type uses four valves per cylinder, whereas the others have two. The 1000 hp. type uses the same cylinders with four valves as used in the 600. The company has also been producing aviation engines of 220 and 300 hp. so that it has been in production in five different models and has the sixth under development.

### Expansion Constant at Panhards

The pioneer firm of Panhard-Levassor is an example of a French maker that has had a large production on four-wheel drive tractors for artillery use and has also manufactured trucks, aviation engines, ammunition, and other lines of war products. The company developed one of its own types of aviation engines which did not develop as satisfactorily as expected and many of which are now used in motor boats. In December it was just completing its government contracts for shells. The factory was in a complete state of expansion. It was one of the few French factories located within the walls of the city placed as it is close to the wall on the South. It has just completed a large three-story foundry of brick and reinforced concrete construction. The lower floor only has been put into operation. The elevators and staircases were just being installed. Panhard has added one of the finest three-story office buildings that exists in Europe. It stands as a monument of the development of the industry under war pressure. The building is largely completed. Adjacent to it are lines of new factory buildings which are just nearing completion. These factory additions are laid out on a modern scale giving large machining rooms as well as assembly floors. A general use of underground tunnels for transportation between buildings is a recently developed feature of the factories. During the war it was necessary for Panhard to utilize every adjacent building in its factory zone. Three and four-story warehouses were converted into machine shops for manufacturing shells. Alleys and every available outside space was utilized for storage of war products. Panhard's work of expansion was really just under way.

# Ricardo Engine "Made Good" in Tanks

Embodies an Unconventional Piston Design and Means for Cooling the Piston, for Preheating the Carbureter Air and for Preventing Any Unvaporized Fuel That Gets by the Piston from Getting Into the Crank Chamber

THE war has brought a new type of internal combustion engine prominently to the front in England. It is the Ricardo engine, which was used successfully in British tanks during the last year of the struggle to the number of about 3000. This engine incorporates means tending toward the more economical use of fuel as well as toward a saving in lubricating oil. The outstanding feature of the Ricardo engine is its piston design. This piston is of the double diameter type, to use a term which has become somewhat familiar in connection with two-stroke engines. But in the Ricardo piston the lower portion is of smaller diameter than the upper, and serves chiefly the purpose of a crosshead, while the upper part carries the piston rings and serves to seal the combustion chamber. The lower part of the piston works in a crosshead guide, which is a sleeve of less diameter than the cylinder and fitted into the lower end of the cylinder in such a way as to project into the crankcase. The large diameter top part of the piston is rigidly connected with the smaller diameter lower or crosshead part by a long tube cast integral with the top part. At its lower end this tube carries the crosshead sleeve, which is a sliding fit in the crosshead guide. The wrist pin is carried in the the crosshead at the bottom, the conventional type of connecting rod being used. The diameter of the tube connecting the top and bottom of the piston is little more than one-half of the cylinder diameter.

Many reasons are advanced for the adoption of this design, and results with the engine in tanks bear out practically all of these claims. The primary object is to get a piston in which the upper part with the rings is entirely free from side pressure and only takes the explosion pressure on its head.

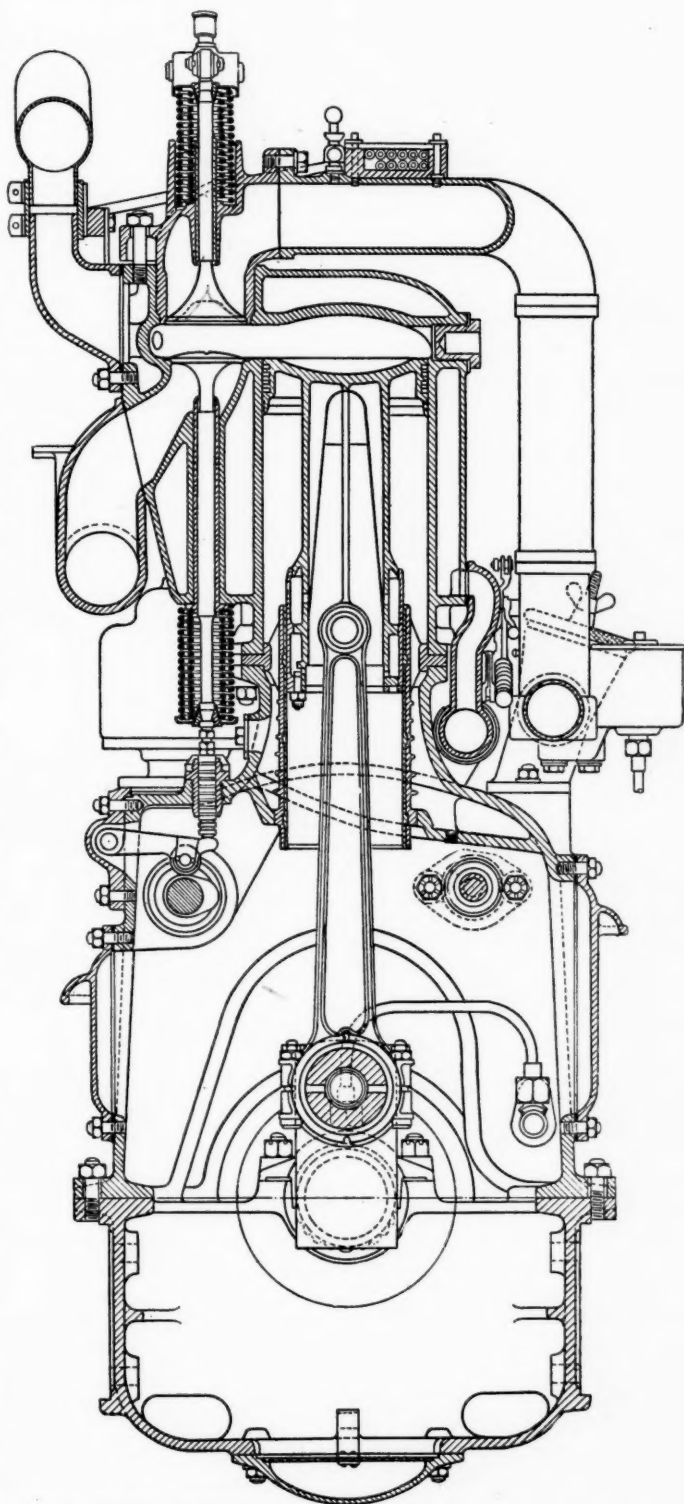
The crosshead taking the side thrust, the piston crown can be made with a relatively loose fit, as high as 0.060 in. clearance being allowed, and there is no pressure on the rings other than their own radial pressure, which is required for retaining compression.

## Piston Design Insures Easy Cooling

A further object was to insure quick radiation of heat from the piston head, which is accomplished by a thick piston crown assisted by the smaller diameter downwardly extending piston tube. This obviates the necessity of relying on a piston skirt.

By securing the wrist pin in the lower or crosshead part it is far removed from the piston head, and its lubrication is proportionally simplified.

The wrist pin possesses several other advantages, due to this unusual location. The pin is short as compared with that used in the skirted piston, and the bosses carrying the ends of the pin are close up against the sides of the connecting rod. This reduces the bending moment on the rod and allows of using not only a shorter rod, but one of smaller diameter, and consequently reduces the reciprocating weight. It is possible to use a pin which floats in the top of the connecting rod and also in the crosshead bosses, which obviates any tendency to local



Cross section through the Ricardo engine, showing the unusual double-diameter piston with crosshead

wear on the pin, in that it tends to a slow rotary motion.

Among other advantages of this mounting of the wrist pin is that it is properly located with reference to the crosshead sleeve, which is the skirt of the piston. It is located approximately midway between the ends.

This crosshead design of piston prevents direct radiation of heat from the piston head to the crankcase, and so keeps the lubricating oil in the case cool. This is largely due to two factors: First, the heat from the piston head is largely radiated by the piston tube, and before it can reach the crankcase it has to be transmitted through the crosshead. Radiation from the piston tube is accelerated by having all the air entering the carbureter pass through the cylinder between the piston head and the crosshead. This air passes to the carbureter at as high a temperature as 150 deg. F. when the atmospheric temperature is 60 deg. F.

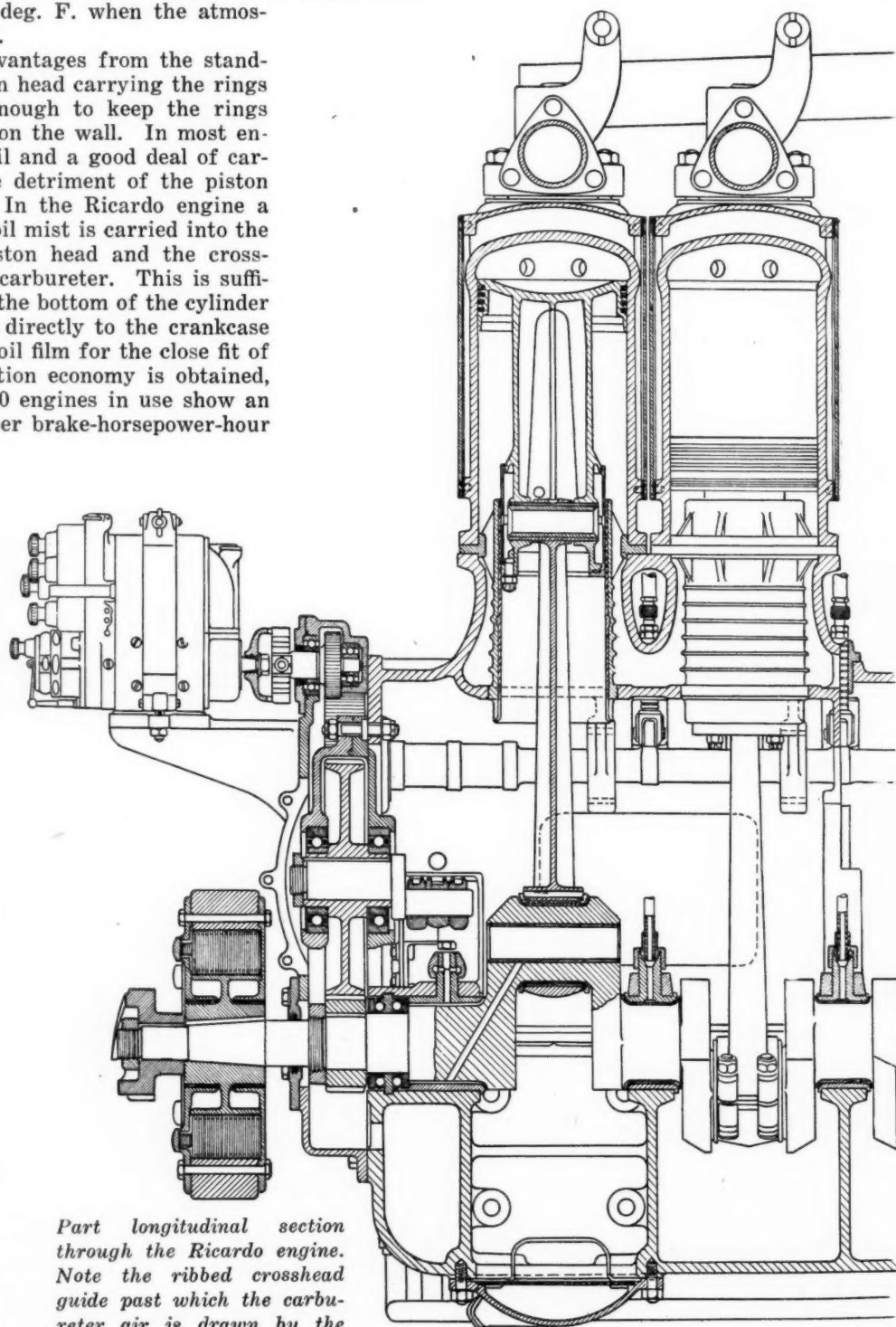
The crosshead piston has advantages from the standpoint of lubrication. The piston head carrying the rings requires very little oil, just enough to keep the rings working and to furnish a film on the wall. In most engines the rings get too much oil and a good deal of carbonization of oil occurs, to the detriment of the piston rings and the cylinder walls. In the Ricardo engine a small portion of the crankcase oil mist is carried into the cylinder space between the piston head and the crosshead by the air passing to the carbureter. This is sufficient for the piston crown. At the bottom of the cylinder the crosshead guide is exposed directly to the crankcase mist, and receives an adequate oil film for the close fit of the crosshead. Special lubrication economy is obtained, and the averages from the 3000 engines in use show an oil consumption of 0.012 pint per brake-horsepower-hour on new engines, which drops to 0.0075 pint per brake-horsepower-hour after use.

Still another advantageous feature of the Ricardo construction is that unburned fuel leaking down past the piston head does not enter the crankcase lubricant. Any heavier fuel particles that get by the piston head are picked up by the air passing to the carbureter and are again carried into the carburetion system. This factor is very desirable for using kerosene and also for gasoline in cold weather.

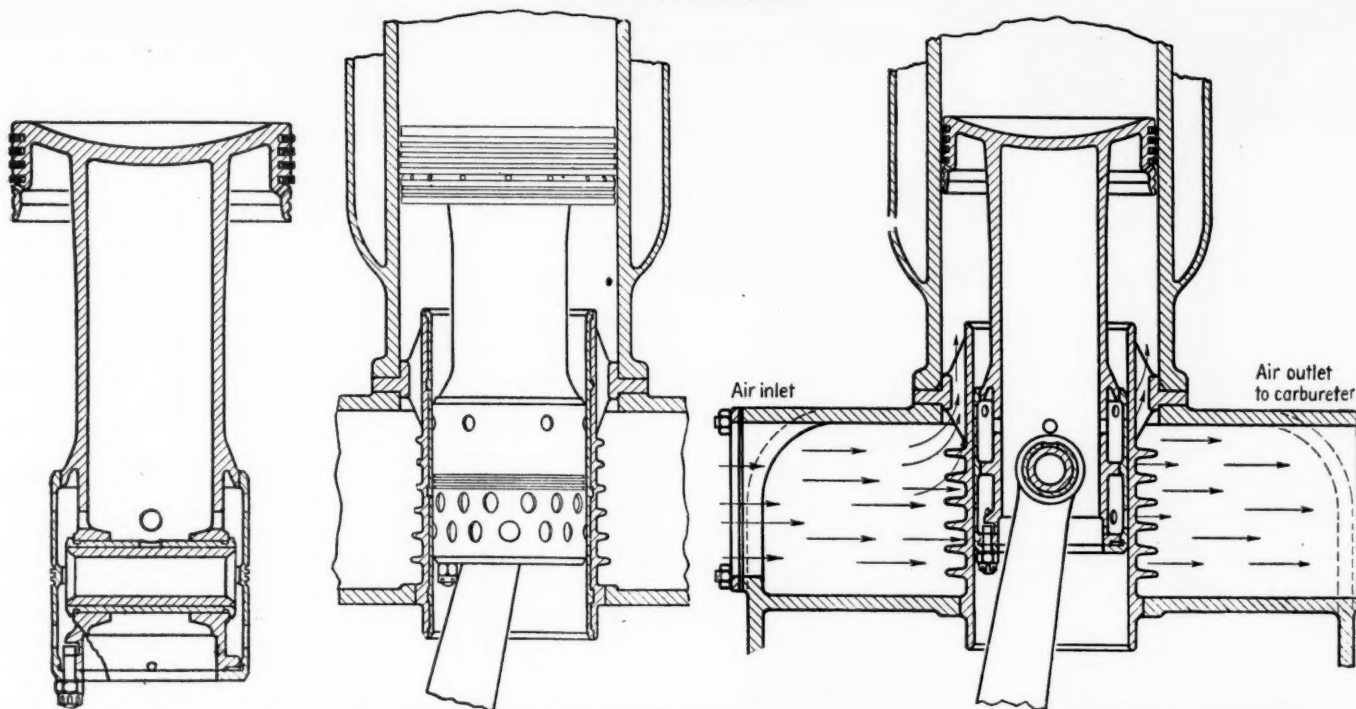
Not the least interesting aspect of this piston design is that it seems to furnish the missing link with aluminum alloy pistons, namely, the means of preventing piston slap when an engine is cold. The aluminum alloy piston has become universal in European aviation engines, where piston slap of a cold engine does not count. However, in passenger cars this slap must be eliminated, and it is also undesirable in the truck and the farm tractor. Ricardo designs the piston head with a loose fit, with as much as 0.060 in. clearance, but fits the crosshead as close as 0.004 in.

The crosshead takes the side thrust and there is no slap.

The Ricardo engine was adopted for tank work owing to the impossibility of getting all the Daimler-Knight engines needed. The tanks originally used the 105-hp. six-cylinder Daimler-Knight, and Ricardo was asked to design his engine to give 113 hp. and to fit in the space used by the Daimler-Knight. The first design was a four-cylinder,  $5\frac{5}{8}$  by  $7\frac{1}{2}$  in., that gave 113 hp. at 1200 r.p.m. A six-cylinder design with the same cylinder sizes gave 170 hp. at 1200 r.p.m. To date four different sizes have been manufactured. The third model has six cylinders,  $6\frac{3}{4}$  by  $7\frac{1}{2}$  in., and gives 255 hp. at 1200 r.p.m. Recently a twelve-cylinder job has been developed which would be interchangeable with the Liberty engine for certain uses.



*Part longitudinal section through the Ricardo engine. Note the ribbed crosshead guide past which the carbureter air is drawn by the action of the piston*



Left—Sectional view of the Ricardo crosshead piston, showing method of attaching the cylindrical crosshead. Center—The piston in place in the engine. Right—Sectional view, showing how the carburetor air is drawn past the ribbed sides of the crosshead guide

Apart from the piston design, the engines are conventional types, with single cast-iron cylinders having valves in pockets on one side, the exhausts in the bottom of the pockets and the intakes in the tops, or directly above the exhausts. Both are operated from a single camshaft within the crankcase.

Using the crosshead piston increases the engine height approximately two-thirds of the stroke, which in the case of the  $7\frac{1}{2}$ -in. stroke engine referred to adds 5 in. to the height. There is an increase of 10 to 15 per cent in engine weight as compared with the same sized engine using a skirt piston. A cold compression of 85 lb. gage is used. The mean effective pressure in the  $5\frac{5}{8}$  by  $7\frac{1}{2}$ -in. size is 100 lb., and in the  $6\frac{3}{4}$  by  $7\frac{1}{2}$ -in. size is 106.5 lb.

Before going into tank use each engine is given a severe test and every fifteenth engine is given a 200-hour test in four runs of 50 hours each at full load on a dynamometer. No work can be done on the engines under test between the 50 hour periods. Every engine has to run 10 minutes while tilted at an angle of 30 degrees without load, and at the end of 10 minutes must go onto full load without smoking or missing. At the end of the 200-hour tests no carbon deposits have been found on the cylinder heads, the only indication of carbon being a mahogany color.

In the design of the engine the use of alloy steels was not permitted by the Government, in order to conserve these steels for the aviation program.

The engine has a mechanical efficiency of 386 per cent when starting up and 87.5 per cent after running.

The design of the engine parts to admit of the crosshead piston, which is a two-diameter one, does not call for unusual complications, as the cross-head guide fitting into the bottom end of the cylinder accomplishes this, leaving the cylinder casting identical with that in an engine using a skirted piston. The crosshead guide is an air-cooled aluminum alloy sleeve supported by a flange which is anchored between the cylinder base and the crankcase. The lower end of the sleeve fits into a sub-top of the crankcase. In the early designs this crosshead sleeve or guide was of bronze, lined with white

metal, but aluminum alloy has been found to give very excellent results. The clearance of the crosshead in its guide ranges from 0.0035 to 0.006 in.

The piston, a die casting, has the crown slightly concaved, and only carries the very thin piston rings, which have a thicker radial measurement. Below the rings the very brief piston skirt is cut back, leaving a clearance of 0.020 in. In manufacture it has to be machined on the two cylindrical surfaces.

The crosshead sleeve is a cast-iron ring or shell fitting over the lower end of the piston tube and is secured thereto by four small bolts. It is an easy push fit on the piston tube. It is supported on the piston tube by three circular bands, the middle one being on the center of the wrist pin. The sleeve can be either cast iron or a steel forging, the former serving for commercial engines.

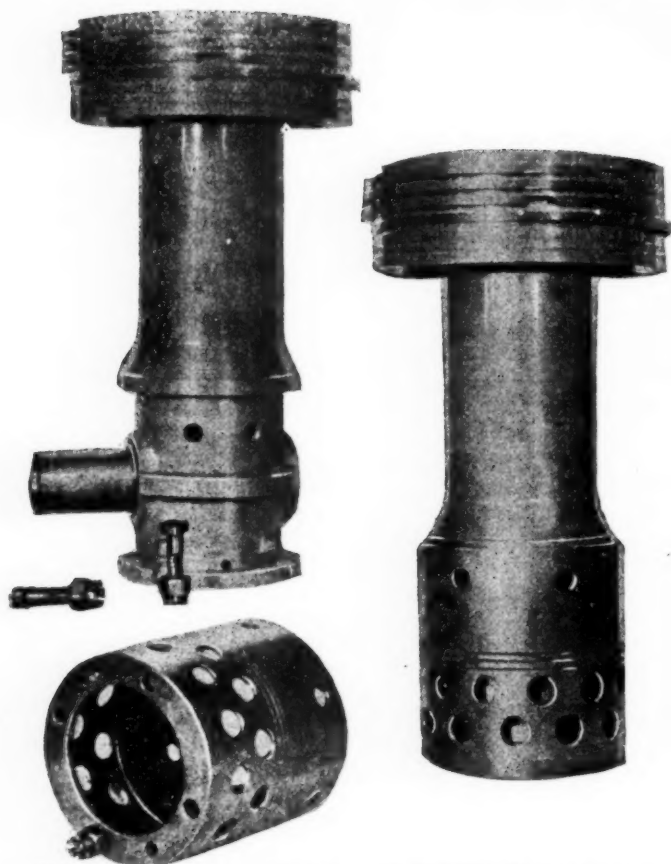
The crosshead piston permits of a short wrist pin, which is bushed in the end of the connecting rod and also in the crosshead bosses, allowing the pin to float. It is oiled by the crankcase mist, and the quantity supplied is quite independent of the throttle.

Nothing unusual is found in the valves and operating parts. They are of 3 per cent nickel steel, low carbon and case hardened. Phosphor bronze valve guides are used. There is little if any pitting of the heads. The timing is:

- Inlet valve opens 20 deg. late.
- Inlet valve closes 17 deg. late.
- Exhaust valve opens 55 deg. early.
- Exhaust valve closes 5 deg. late.

A careful masking of the inlet valves has shown very satisfactory results.

In carburetion use is made of the space between the crankcase top and the sub-top for the circulation of air around the crosshead guide. The air enters at one side and passes out to the carburetor on the other side. A portion of the air is drawn directly round the crosshead guide, and the remaining portion passes between the guide and the cylinder through slots provided for this purpose. On the upward stroke of the piston the air is drawn through these slots at a high velocity, and impinges



*The Ricardo piston complete and disassembled, showing the crosshead which is bolted to the piston extension*

upon the crown and stem of the piston, thus effectually cooling them. On the downward stroke this heated air is discharged again into the chamber surrounding the guides, and thence into the carbureter. By this means the piston and crosshead guide are kept cool and the carbureter air is warmed.

It is found in practice that the heat abstracted from the piston and crosshead guide is just sufficient to overcome the latent heat of evaporation of the gasoline when running on full load, and rather more than sufficient on reduced loads. Tests carried out with thermometers fitted in the induction piping above and below the carbureter have shown that when running on full load with an atmospheric temperature of 60 deg. Fahr. the air, after passing round the crosshead guides and pistons, entered the carbureter at a temperature of 130 deg. Fahr.

The temperature immediately above the throttle was found to be 70 deg. Fahr., and near the top of the induction pipe, where evaporation appears to be complete, it was found to be 60 deg. Fahr., showing that the heat abstracted from the pistons and crosshead guides was just sufficient to replace that absorbed in overcoming the latent heat of the fuel, while the total drop in temperature of 70 deg. Fahr. showed that practically the whole of the fuel was evaporated before entering the cylinder. On a light load, with consequent reduced air circulation, the temperature of the air entering the carbureter rose to 150 deg. Fahr., and the temperature near the top of the induction pipe was sufficiently high to check condensation at reduced loads. The free circulation of air through the upper portion of the crankcase tends to keep the lower portion cool, so that no oil cooling is required. Further, the crankcase is not exposed to the heat radiated from or carried away by the lubricant from the inside of the piston crown.

As the upper end of the piston is to a certain extent

isolated from the crankcase, special provisions had to be made to insure its lubrication. The lower portion of the stem of the piston is provided with a few small holes, and the crosshead sleeve which surrounds it is also provided with a ring of small holes so placed that these holes are uncovered above the guide at the top of each stroke. On the upward stroke of the piston air is drawn through slots provided in the flange of the crosshead guide between the guide and the cylinder, and passes at a very high velocity around the crosshead sleeve; in doing so it draws a small proportion of air and oil mist from the holes in the crosshead sleeve, which are in communication with the crank chamber through the corresponding holes drilled in the piston stem. The oil issuing from these holes in the form of a mist is picked up by the rush of air and sprayed over the cylinder walls while the piston is near the top of its stroke; the total quantity of oil drawn out in this manner is exceedingly minute, but it is sufficient for the maintenance of the piston rings. The whole operation is similar to that of a carbureter in which the slots in the crosshead guide correspond to the choke tube and the holes in the sleeve to the jets. The control of the quantity of oil delivered in this manner is governed by the area of the slots and the size or number of holes provided in the sleeve.

It will be noted that by this means the lubrication of the cylinder walls is continuous, that it is independent of the suction in the cylinder, that oil is only supplied to the

cylinder walls in the quantity required by the piston rings, and that oil which has clung to the walls and become partially carbonized does not find its way back into the crankcase.

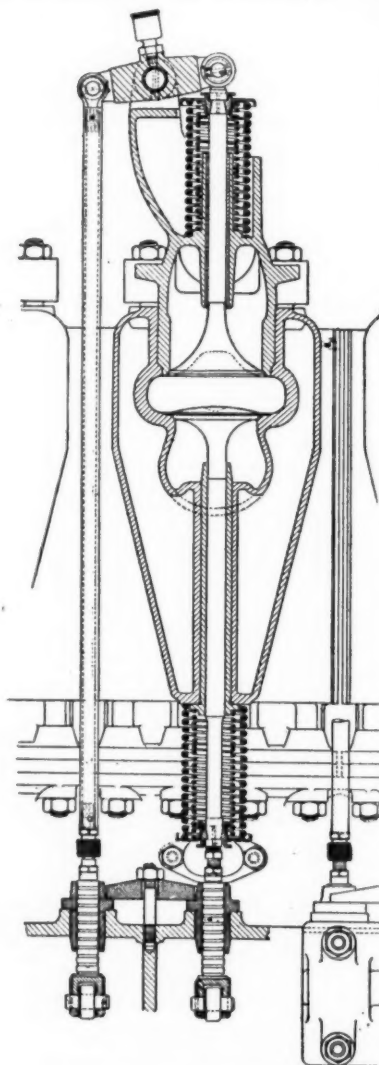
The advantages of the Ricardo piston may be summarized as follows:

(1) The lubrication is under complete control, and is independent of the suction in the cylinder; consequently the oil consumption, the tendency to carbonize both the piston and combustion chamber, and the risk of oiling up the sparking plugs are all reduced to the minimum.

(2) The piston friction is reduced to about half that which obtains with an ordinary truck piston.

(3) Owing to the fact that the crosshead and guide are relatively cool, and that both are maintained at approximately the same temperature, a very fine running clearance can

(Continued on page 443)



*Sectional view through the valves and valve gear of the Ricardo engine*

# Generation and Storage of Energy in Magnetos

How the Spark Energy Is Generated by the Armature Motion and Stored in the Magneto During the Short Circuit Period

By Harry F. Geist, E. E.

THE magneto generator, as used for ignition purposes, generates and stores the energy which subsequently goes into the ignition spark, during a period of operation while its winding is short-circuited. When the spark is desired, the winding is suddenly open-circuited, with the result that the stored energy is delivered in the form of an electrical spark.

Fundamentally, this stored energy, which is electromagnetic in form, is present in the combined electrical and magnetic circuits of the machine in the form of a reactive magnetic field and also in the form of a distortion of the excitation flux distribution due to this reactive flux, that is very different from what the flux distribution would be on open circuit for the same armature position, so that it naturally follows that a sudden change from the short circuit to the open circuit condition will result in a very sudden magnetic readjustment that produces the delivery of the stored energy to the ignition spark.

It is the purpose of this article to explain how the energy is generated due to armature motion and stored in the magneto on short circuit, pointing out by the aid of diagrams how the reactive flux is set up, influencing the shifting of the main or excitation flux from the magnets of the machine, and affecting current flow in the windings. The writer will endeavor to cover briefly all the important phenomena connected with the short-circuit operation of the ignition magneto.

In AUTOMOTIVE INDUSTRIES, Vol. XXXIX, page 616, in an article, "Magnetism In Magneto Generators," under Analytic Measurements, the writer gave a brief description of the physical dimensions of a low-tension magneto and of the set-up for the oscillographic test by which the oscillogram of the open circuit e.m.f., illustrated in Fig. 4 of that article, was taken. Special attention is here called to the fact that the oscillogram shows that when the armature was in the vertical position a relatively high voltage was generated.

## Short Circuit Current

In Fig. 1 is now presented an oscillogram showing the current generation on short circuit for the same machine, taken under the same general testing conditions, so that in this oscillogram, just as in the oscillogram of the open-circuit e.m.f., the armature position is definitely marked.

Fig. 1, therefore, represents both a current-time and a current-armature position record of the performance of the machine on short circuit, at a speed of about 630 r.p.m., as checked directly from the 60 cycle wave represented therein.

The principal disclosures of this record are that the current wave is a very broad and flat one, indicating considerable firing range in the magneto, and that the current changes its polarity each time the armature passes

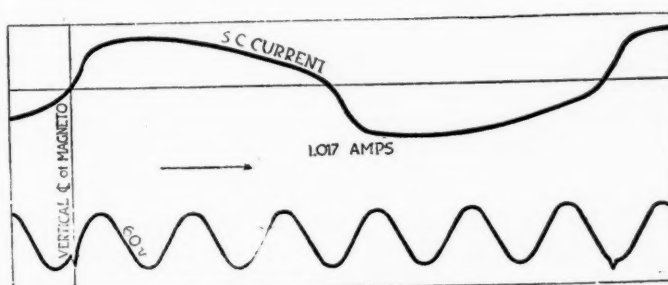
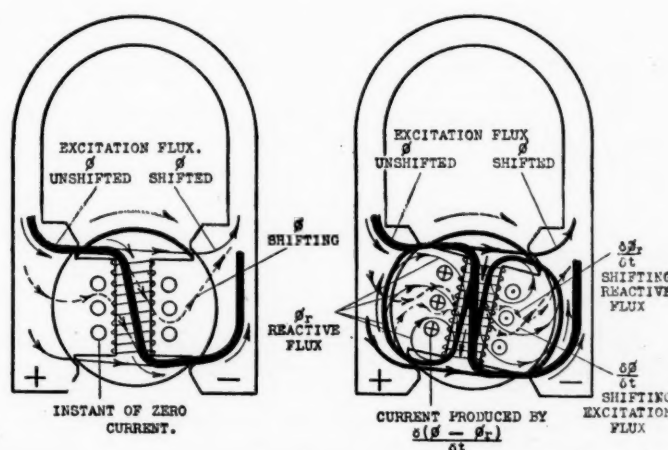


Fig. 1—Oscillogram of short circuited armature current

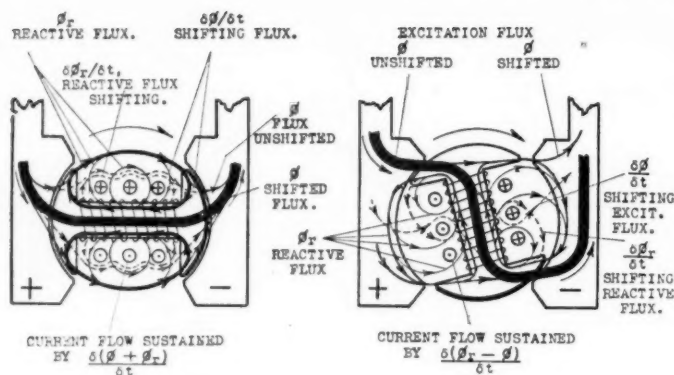
the vertical position for this particular speed of operation. The current flow in amperes is also indicated on the oscillogram and the sequence of events is as shown by the arrow.

By comparing the short-circuit current wave with the open-circuit voltage wave, it will be seen that there is a lag between the armature position at which the short-circuit current rises to its maximum and that armature position at which the open-circuit e.m.f. rises to its maximum. It is this lag or retardation effect upon the manner in which the generating flux shift is produced on short circuit as compared with the more natural shift which takes place on open circuit, that is caused by the reactive flux set up in the magnetic circuits of the machine due to current flow in the generating winding.

The following flux distribution diagrams (Figs. 2, 3, 4 and 5) represent an attempt to show as completely as is possible how the reactive flux is set up in the machine, and its effect upon the excitation flux distribution, as well as the manner in which both the reactive and the excitation fluxes shift with respect to the winding.



Figs. 2 and 3—Showing flux distribution for two armature positions



Figs. 4 and 5—Flux distribution for two other armature positions

In these diagrams, just as in discussions of magnetic phenomena, the excitation and the reactive fluxes will be shown as separate entities, even though they do not actually exist as such, and the general plan is followed of joining these forces where they flow in the same direction through the same path, and of giving them slightly separated paths where they tend to flow in opposite directions in the same path. An endeavor has been made also to show the fluxes in about the proportions in which they exist for the different armature positions shown.

Shifting fluxes are shown in dotted lines and are given a curved effect with respect to the conductors they are shifting across. In connection with shifting fluxes, it might be pointed out here that as the armature face tips leave the pole piece tips, and as the opposite tips meet, excitation flux will shift across the winding, leaving the separating tips toward the meeting tips. For the direction of rotation shown in Figs. 2, 3, 4 and 5, this shifting excitation flux travels down on the left and up on the right-hand side of the coil, or always toward the "shifted flux" as designated.

As current increases in the winding, the reactive forces increase, the loops of reactive flux increase in number, and in so increasing, additional loops of reactive flux shift across the turns of the coil, beginning at the magnetic center, until they include the path formed by the armature core, armature faces and pole pieces. For decreasing current, these loops in dying out will decrease in the scope of their path inward toward the magnetic center of the winding and thus also will shift across the coil turns. This shifting of reactive flux has an effect similar to the shifting of the excitation flux, the effect being in proportion to its rate.

In these diagrams, a direction of rotation and a polarity of the magnets are assumed, and one face of the armature is shown heavier than the other in order that the amount of armature motion from one position to another be more easily followed.

Fig. 2 shows the armature in the vertical position, which, according to the oscillogram, Fig. 1, is the position of zero current. The conditions as represented in Fig. 2 depend upon phenomena occurring as the armature approaches the vertical position, so that Fig. 2 will not be discussed until after Fig. 5.

#### Position of Zero Current

As the armature passes from the vertical position to that represented in Fig. 3, the current rises toward its maximum value. This current is due to the fact that the excitation flux shifting across the coil generates an electromotive force that causes current flow in the closed circuit. While this current producing voltage is purely the result of the excitation flux shift and will vary as

$\delta\phi/\delta t$  varies, it is further influenced by the fact that as the current increases in value, the reactive flux  $\phi_r$  will increase in value correspondingly and will shift across the coil at a rate  $\delta\phi_r/\delta t$ . This shifting of reactive flux takes place in a general way in the opposite direction to that in which the excitation flux is shifted across the coil, so that it is evident that the current is produced by the resultant of these two shifts, which is expressed by  $\delta(\phi - \phi_r)/\delta t$ . Owing to the fact that the generating shift must be greater than the reactive shift which it produces, this resultant shift is expressed by the difference as shown. The current flow in the winding will be in the direction indicated by the three turns in cross section.

Attention is called in Fig. 3 to the fact that the loops of reactive flux flow in the same direction as the excitation flux at the separating armature and pole piece tips, and in an opposite direction at the meeting tips, which accounts for the fact that the excitation flux is retarded in its shifting by the reactive flux, for it will be appreciated that on open circuit, with an absence of the reactive flux, the direction of the excitation flux through the armature would be directly opposite. The diagram also shows that all the reactive loops do not interlink with all the coil turns and shows that the magnetic center, that is, the center from which all reactive loops arise and return, is at the opposite end on each side of the coil from the separating tips.

Fig. 3 shows the armature in about the position of maximum energy storage. This energy exists, as was previously mentioned, in the presence of the loops of reactive flux interlinked with the coil, and in the fact that the excitation flux is held in an unnatural path with respect to the coil by this reactive flux. The energy which is thus stored is generated by the shift of the excitation flux, produced by the motion of the armature and its consequent co-action with the pole pieces of the machine.

#### Position of Maximum Current Flow

As the armature passes on to a position of about 50 deg. beyond the vertical position, the current reaches its maximum value and then begins to decrease in amount, because the actual generation of energy has dropped off to a rate that is less than the amount that is being continually consumed in the copper and iron losses of the machine.

Fig. 4 shows the armature when it has about reached the horizontal position, and illustrates the phenomena taking place with the current thus decreasing in value. This figure shows practically all of the excitation flux shifted and passing directly through the armature core, but shows a stray flux still unshifted that is negligible for this position. The reactive flux loops  $\phi_r$  will take the path as shown, and it will be noticed that these loops have a more difficult path than that of Fig. 3.

With the current decreasing, and the reactive flux decreasing likewise, there will be a shifting of the reactive flux  $\delta\phi_r/\delta t$  across the coil as these loops die out toward the magnetic center of the winding. This center, it will be seen, has changed for each side of the coil to a position on the vertical center line of the machine, about as shown.

The dying out of the reactive flux and the shifting of the rest of the excitation flux are both now in the same direction with respect to the coil, so that from the instant the current begins to decrease, up to the neighborhood of the position of Fig. 4, the resultant flux shift is seen to be  $\delta(\phi + \phi_r)/\delta t$ . This resultant flux shift rate has a sustaining effect upon the current flow and accounts for the fact that the current decrease is very gradual. When all the excitation flux is completely shifted with

respect to the coil this resultant flux shift rate becomes  $\partial\phi_r/\partial t$ .

As the armature passes on toward the position of Fig. 5, the tendency is for the excitation flux to again begin to shift with respect to the coil, passing down on the left-hand side and up on the right-hand side, thus changing from the path of the unshifted to the path of the shifted excitation flux, as shown in the diagram. The reactive flux is still present and still decreasing in value, so that it is seen that the shifting of the excitation flux now opposes the shifting of the reactive flux, i.e. the motion of the armature is now tending to generate energy to destroy the stored energy still existing in the machine, with the result that the resultant flux shifting rate is now  $\partial(\phi_r - \phi)/\partial t$ . Here still the component  $\partial\phi_r/\partial t$  is the greater, but  $\partial\phi/\partial t$  is overcoming it at an increasing rate. In Fig. 5 it will also be noticed that the magnetic center for each side of the winding is directly opposite from where it was in Fig. 3, showing how the magnetic center of the machine changes with the armature during its rotation.

### Shifting of Flux Balances Stored Energy

When the armature reaches the vertical position, as represented in Fig. 2, the shifting of the excitation flux has completely overcome the stored energy and the current has reached the zero value. This position is an instantaneous one, and the shifting flux  $\phi$  shown is part way between the unshifted and shifted positions. Due to the fact that the current is zero, there can be no reactive flux left from the original generation of Fig. 3 or resulting from the new generating tendency of the shift explained for Fig. 5.

For the next half revolution the magnetic and electrical phenomena repeat themselves, but inasmuch as the armature and coil are inverted with respect to the field, from what they were during the half revolution discussed, the forces set in action will be of opposite polarity.

A general review of the diagrams shows that useful generation takes place from the vertical position of the armature for about 50 deg. of motion, after which the coil serves almost purely as a reservoir, this reservoir being emptied by the generating effect during the last part of the half revolution, in addition, of course, to the continual consumption of energy by the coil resistance and the iron of the machine.

During the half revolution, the resultant flux shift is seen to change from  $\partial(\phi - \phi_r)/\partial t$ , to  $\partial(\phi + \phi_r)/\partial t$ , and after the original flux shift  $\partial\phi/\partial t$  has died out and the new one begins, to  $\partial(\phi_r - \phi)/\partial t$ , so that it is apparent that the reactive flux plays an important part through the complete half revolution.

Throughout the phenomena, the general effect of the reactive flux is to stabilize the current flow in the machine, hindering it in its generation, and retarding also its decrease. This retardation effect results, as has been shown, from both a regenerative effect upon the coil itself and from the distorting effect upon the distribution of excitation flux.

### Regenerative Effect of Reactive Flux

The regenerative effect of this reactive flux upon the coil itself is what is known as the effect of inductance, while the distorting effect upon the distribution of the excitation flux is what is known as armature reaction. A third limitation to current flow, which is well known, is the resistance of the winding itself, but inasmuch as its general effect has little bearing on the wave shape of the current flow on short circuit, only a mention of it will be made at this time.

It is well known that an electromagnetic circuit, having an inductance  $L$ , in which a current  $i$  is flowing, will store energy in accordance with the following equation:

$$W_1 = \frac{L i^2}{2} \quad (1)$$

In addition it is also apparent that during the armature motion from the position of Fig. 2 to that of Fig. 3 or until  $\partial\phi_r/\partial t$  begins to exceed  $\partial\phi/\partial t$ , each line of reactive flux will hold an equal line of excitation flux in an unnatural position with respect to the coil, so that for this range of armature positions the stored energy due to armature reaction must be about equal to that stored due to inductance, or the total stored energy can be expressed by,

$$W = Li^2 \quad (2)$$

Therefore the inductance effect and the armature reaction are both factors in the stored energy of the magneto.

The value of the current  $i$  in amperes is obtainable for any armature position directly from the oscillogram of Fig. 1, so that if the inductance in henrys of the circuit can be ascertained for different armature positions, the stored energy for any armature position is calculable in joules from the foregoing equations.

If an alternating electromotive force, of known frequency and sinusoidal in its wave shape, is impressed across the terminals of the magneto coil, with the magnets removed from the machine, and this emf. is of such a value that as small a current as can be accurately measured will flow, then for any armature position the impedance  $Z$  of the circuit is obtainable, by dividing the impressed voltage by the current flow resulting.

### Impedance

It is well known that the impedance  $Z$  is equal to the square root of the sum of the squares of the reactance  $X$  and the resistance  $R$  of the coil, and since  $R$  can be easily obtained by the use of a Wheatstone Bridge, and in this case proved to be 4.02 ohms, the value  $X$  is readily obtainable from  $Z$  and  $R$  by calculation.

For a sinusoidal voltage wave form of frequency  $f$  the following law holds true,

$$L = \frac{X}{2\pi f} \quad (3)$$

and from it the value of the inductance can be calculated for any armature position for which  $X$  is known.

A series of inductance measurements was made following the above method for different armature positions of the magneto from which the oscillogram of Fig. 1 was taken, and the results are shown in the Inductance-

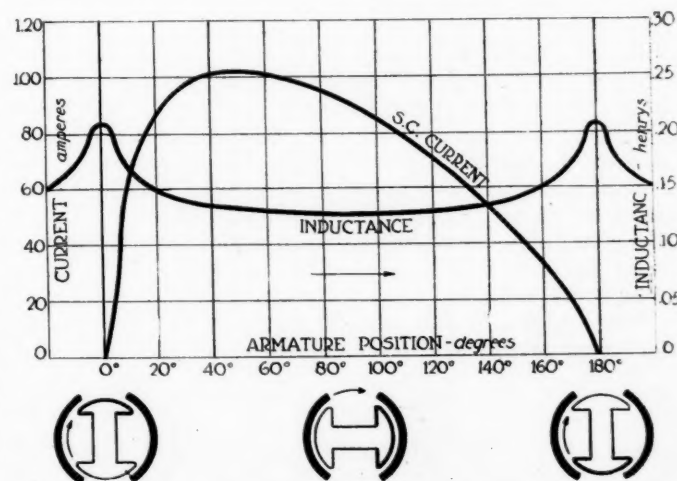


Fig. 6—Armature position-inductance curve

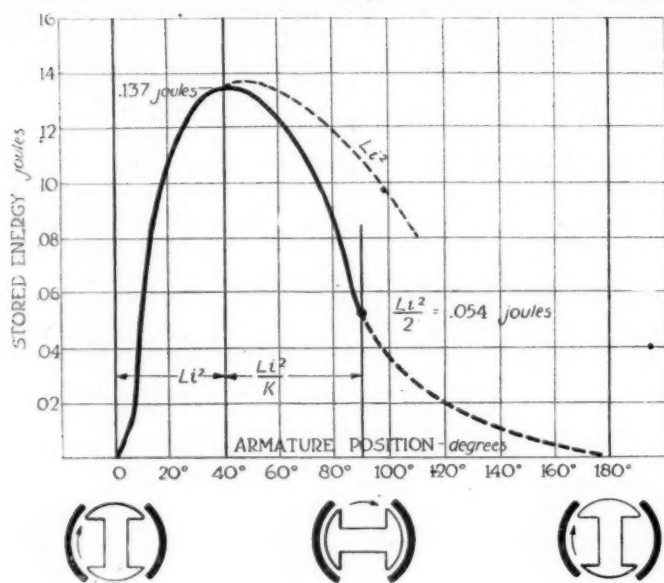


Fig. 7—Curve of stored energy

Armature Position curve of Fig. 6. The short-circuit current as reproduced from the oscillogram is also included in Fig. 6, so that from these two curves it is possible to calculate the amount of stored energy in the magneto for different armature positions.

In Fig. 6 attention is called to the fact that the inductance of the circuit is a maximum when the armature is in the vertical position. This is what would naturally be expected because for this position the reactive flux has complete iron paths through the armature core, armature faces and pole pieces, with the exception of the clearance gap between the rotor and the stator, while for the horizontal position the loops of reactive flux have a much more difficult path and the inductance will, therefore, be a minimum for that position. Thus it is seen that the inductance of the circuit varies very materially as the armature changes positions during its rotation. The resistance of the winding will, of course, be constant.

It was pointed out that the stored energy for armature positions from Fig. 2 to Fig. 3 is the sum of the effects of inductance and armature reaction, and is therefore the amount calculable from equation (2) by the use of the data represented in Fig. 6. Equation (2) holds true in this magneto for the speed at which the oscillogram was taken, from the vertical position to about 40 deg. after the vertical.

#### Value of Stored Energy

In Fig. 7 the calculated results are plotted and the curve shows how the stored energy increases from zero to its maximum of about 0.137 joule as the armature moves through the first 40 deg. From the 40 deg. position on to the 90 deg. or the horizontal position, the armature reaction component of the stored energy gradually dies out, so that for the horizontal position the stored energy will be due almost entirely to inductance and will be of an amount calculable from equation (1), which gives 0.054 joule.

Between the 40 deg. and 90 deg. positions, therefore, the stored energy will follow the equation,

$$W = \frac{L i^2}{k} \quad (4)$$

where  $k$  is a numerical quantity varying from 1 to 2 for the included armature positions, so that the curve for the range of positions from 40 deg. to 90 deg. will have to be to some extent an approximation.

The amount of stored energy after the horizontal position for the last quarter of a revolution is of very little consequence, because the stored energy is below a useful value even before the armature reaches the horizontal position.

From Fig. 7 it is seen that the magneto under consideration has a comparatively high value of stored energy at 630 r.p.m. for about 50 deg. of motion. This range, of course, results from a constant speed of operation. In starting an engine, with the spark occurring late, say at 60 deg., the starting speed will be comparatively low, perhaps only about 200 r.p.m., so that the energy available for the spark at that position of the armature and speed will not be as high as that shown in Fig. 7. The true firing range of a magneto has to allow for low-starting speeds. However, it is evident that this magneto has ample firing range for ordinary service. It is also apparent by comparing the Stored Energy-Armature Position curve of Fig. 7 with the Current-Armature Position curve of Fig. 6, that there is a great deal of difference between the current range and the sparking range of a magneto.

#### Stored Energy on Short Circuit Dissipated in Heat

The question might be asked as to what becomes of the energy generated and stored in the machine on continuous short circuit, when the circuit is not interrupted to produce an ignition spark. All the energy that is generated in the machine during each half revolution of the armature is dissipated during that half revolution in the form of iron losses in the magnetic circuits and copper losses due to the resistance of the winding. At those positions of the armature where energy generation is very high, the energy generation exceeds the amount consumed, so that most of the energy is stored as previously explained, but after the generation dies out the stored energy will continue to be expended in the copper and iron losses.

During the period of generation, energy storage, and energy dissipation in copper and iron all take place simultaneously, so that a complete dispensation of the energy generated is practically impossible.

However, from the data contained in the oscillogram Fig. 1 in connection with the fact that the coil resistance  $R$  is known, it is a simple matter to determine the amount of copper loss, by the use of the following equation,

$$W_r = \int_0^t i^2 R \delta t \quad (5)$$

where  $i$  varies with  $t$  as is recorded by the oscillogram, and  $R$  is 4.02 ohms. The indicated integration can be carried out by a step by step summation for small intervals of time  $\delta t$  covering the 0.0476 second required for the half revolution at 630 r.p.m.

Such a calculation made for this magneto shows the total copper loss for the half revolution to be 0.111 joule. Of this amount 0.08 joule was spent after the 40 deg. position from the 0.137 joule stored, so that it is evident from the difference that iron loss is also a very important consideration in this type of machine.

#### Energy Available for Spark

However, these calculations are secondary considerations in the phenomena that occur during the rotation of the armature, as compared with the simple, direct and fairly accurate determination that can be made of the energy available for an ignition spark for any armature position on the firing range of the magneto.

The discussion thus far has dealt principally with the phenomena occurring during one complete magnetic shift of the machine for one particular speed of operation. In

order to show how the performance of the magneto varies with the speed at which the armature revolves, the effective short-circuit current was measured by means of an electro-dynamometer for different speeds ranging from zero up to about 1400 r.p.m.

The results of this test are plotted in the form of a graph in Fig. 8, which shows how the current increases very rapidly for increases of speed until the armature attains a speed of about 300 r.p.m., after which the increase is more gradual and after 600 r.p.m. the current becomes practically constant.

As the speed increases from zero, the tendency is for the impedance voltage generated in the machine to increase with it and thus cause a higher current flow, but as the speed increases, the resulting current changes and their consequent inductive effects will set up a counter e.m.f. that also increases with the speed, so that a speed will soon be reached at which the increase in generated voltage is neutralized completely by the counter e.m.f., with the result that the current flow will then maintain a constant effective value regardless of speed increases.

From an energy standpoint, an increase in armature speed means additional mechanical energy to be transformed into electrical energy, so that there must be an increase in the electrical energy generated. Part of this increased energy is consumed in iron losses, which increase rapidly with the speed, while the rest goes into increased energy storage, giving the machine a greater storage range and being accompanied by a broadening of the current wave shape.

Increasing or decreasing the number of turns of the coil will increase or decrease the inductance of the circuit, so that such a change in the winding will result in a change in the Speed-Current characteristic of the magneto performance. As an illustration of this change, the two dotted curves are included in Fig. 8. Any other changes in the physical proportions of the magnetic cir-

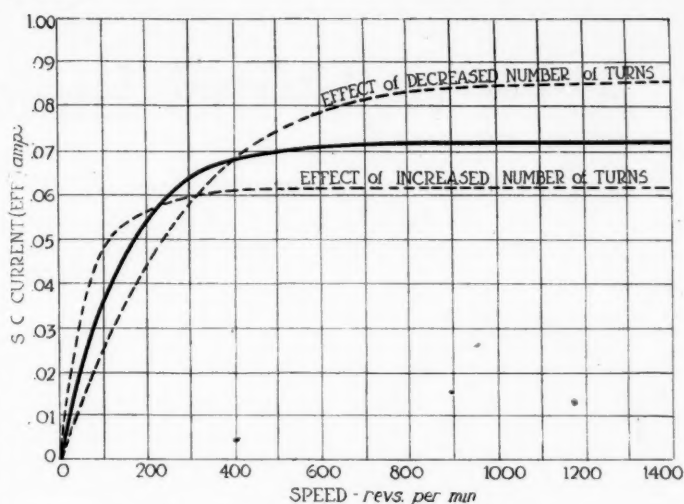


Fig. 8—Diagram showing effect of changing numbers of armature turns

cuits of the machine that will increase or decrease the inductance of the circuit, without reducing the generative ability of the magneto, are also very good methods of adjusting the Speed-Current performance, although their effects upon the wave shape of the current generated and upon the firing range of the machine will have to be taken into consideration.

While the foregoing treatise covering the generation and storage of energy in magnetos during its operation on short circuit is based upon tests and observations made upon a low-tension magneto, it must be understood that the same general laws and phenomena hold true for the generating winding of a high-tension magneto, inasmuch as the features that tend toward high generating and storage ability in a low-tension machine are also the basis of an efficient high-tension magneto.

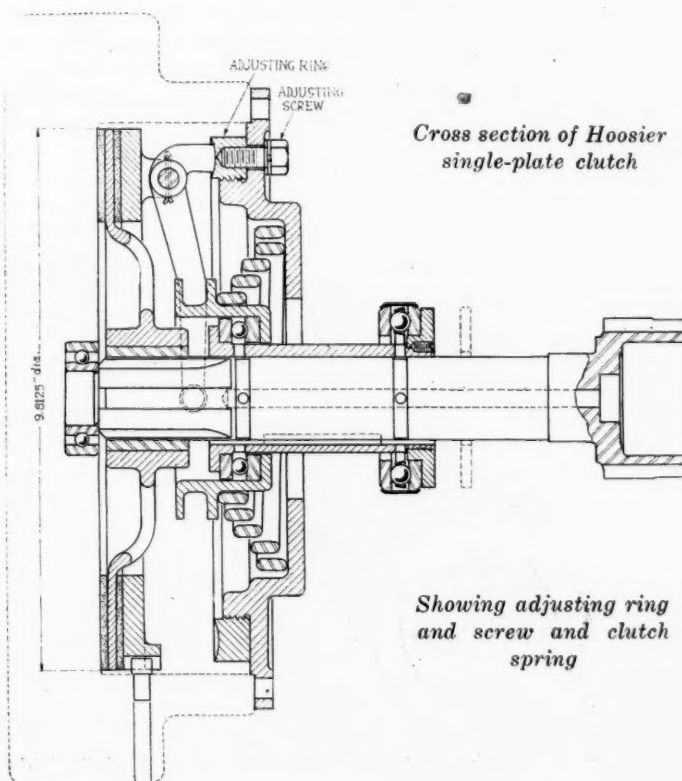
## Hoosier Clutch Redesigned

THE Hoosier single-plate dry-disc clutch, manufactured by the Hoosier Auto Parts Co., Muncie, Ind., has been redesigned and improved. This clutch is of simple construction and is provided with adjusting means whereby the points of support of the clutch clamping levers are moved in the direction of clutch action. The adjustment is made by loosening the adjusting screw, which enters the adjusting ring through a 5-in. slot in the cover plate, and turning it to the right end of the slot, whereby an adjustment of 1/64 in. is obtained. If a larger adjustment is required, the screw is taken out and inserted in a tapped hole then showing in the left end of the slot. The adjusting operation may then be repeated until the desired adjustment is obtained.

### Details of Adjusting Ring

The adjusting ring is threaded, there being 10 threads to the inch, and screws over a threaded flange on the cover plate; as the ring moves out horizontally from the cover plate it moves the three clamping levers toward the clutch plates and maintains them in the same relative adjustment at all times, so that the pressure against the friction discs will always be the same all around.

The adjusting ring can be moved axially at least 1/4 in., and as the two friction discs have a thickness of only 1/4 in. each, the adjustment is sufficient to allow for any possible wear. Hoosier clutches are made in 10-in. and 12-in. sizes to fit all standard makes of engine and transmission and are adapted for either unit power plant or for separate transmission installations. They are also interchangeable with other clutches of similar type.



# A New Windshield for Closed Bodies

Upper and Lower Parts in Inclined Planes Cutting Each Other in the Line of Vision—Greater Protection Against Rain Combined with Clear Vision Effect

By George J. Mercer

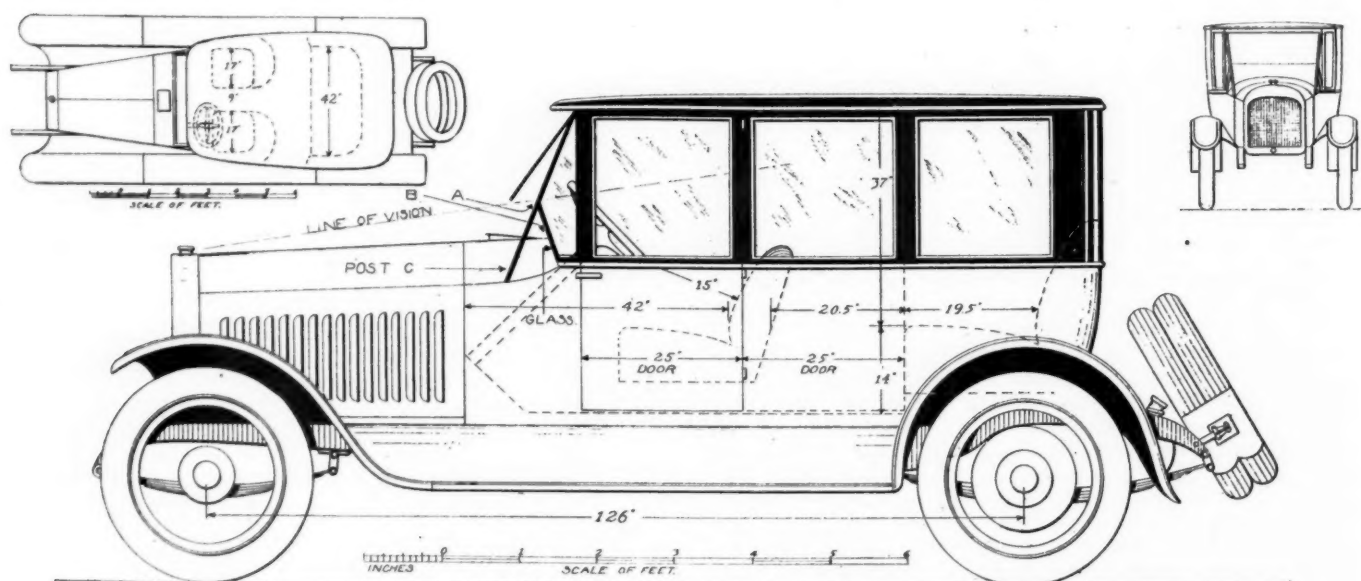
**T**HE regulation slanting shield, set at an angle of 17 to 21 deg. from the vertical, possesses such merit that it is used on the majority of cars, but it has been found in practice that rain, when driven by the wind, will lay on the glass, even when the speed of the car is only 12 miles per hour. So the lower glass is made stationary and the joints at the side and bottom are made watertight, but assuming that the rain is coming toward the front on line A (Fig. 1), if the wind pressure is sufficient, the rain will be forced in the direction of the arrow and will enter the opening indicated by the line of vision. To prevent this, a rubber channel is slipped over the top edge of the lower glass, and the upper, when jammed tight against it, will form a step or offset from the glass surface and thus deflect the water, but this means that the front is closed entirely and the car is being driven through a misty glass. Of course, there are methods of minimizing this difficulty, such as wiping the glass with newspaper that contains a small quantity of kerosene, or having a wiper operated from the inside that will keep clear a space in front of the driver. Sometimes a double upper glass is used, the outer acting as a shield for the inner, but this latter will not keep condensation away. In fact, nothing is equal to a clear vision, and it does not have to be large to be effective.

At the Salon last January, Brewster & Co. exhibited an inside drive body on which the windshield, instead of being in one plane from top to bottom, was made up of two angles meeting in a point or apex at the opening, the same as the shield herein illustrated, the apex in the illustration being on the line of vision. Also, the member marked post C is continued down to the cowl to make a

strong support for the roof and to withstand the impact against this member when the car is suddenly stopped and the pitch of the weight above is concentrated against the front. The Brewster body did not have to withstand such strain, as body and roof were exceptionally light; therefore, its front was formed only by the two angles. Also, the upper glass was not hinged at the top, but travelled up and down in grooves in the post and was operated by an inside handle, similar to a window regulator.

The chief advantage of this shield, however, is that the rain is deflected downward and away from the opening. Assuming that the rain is coming along line *B*, which is parallel to *A*, the line of travel when it meets the lower glass will be as indicated by arrow *B*, and if no rain can enter from below, it will be possible to open the upper glass just enough so that the rain will not enter, and a clear vision for driving is gained. Besides, no water can get into the car, except the negligible amount that may come in through the sides.

The construction of this front will present no difficulty to the body builder, though it involves a little additional work, as compared with the regular shield. The best plan will be to make this a one-piece casting of bronze, the casting to include the bottom member as well as the upright covering the lock pillar on the left side and the entire pillar on the right side. This necessitates welding in two places on the latter, at the top rail and the belt rail to the side panel. The cross member that will join the two side members together at the bottom is also a casting, in which a cored groove is cast to receive the lower glass. This cross front member is fastened



*Fig. 1—Closed body with special windshield having upper and lower glasses inclined to each other*

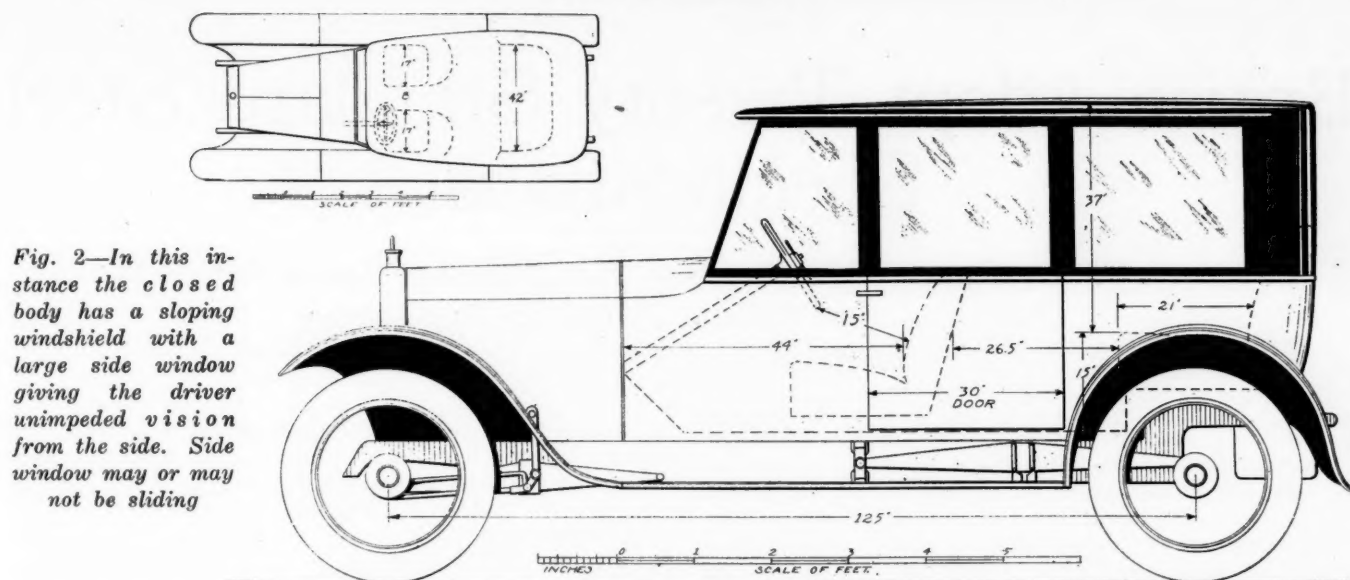


Fig. 2—In this instance the closed body has a sloping windshield with a large side window giving the driver unimpeded vision from the side. Side window may or may not be sliding

on top of the body cowl framing, and the joint is covered by the wide belt moulding, a continuation of the side belt that also covers the lap of the metal panel. This front appearance is illustrated in Fig. 1. One of the advantages of this shield is that it permits of a longer cowl line than ordinary.

With inside drive bodies the matter of vision is so complex that no single design can meet all the requirements. In connection with Fig. 1 the problem of keeping out the rain has been dealt with in such a manner that the glass may be opened when it is raining and still keep out moisture. Fig. 2 illustrates another phase of the problem of inside drive bodies. This represents a type of shield now in actual use.

The advantage of the shield shown in Fig. 2 is that the driver has an unimpeded vision from the side, which is not the case when a vertical post is placed near the front. When driving straight ahead this post is not objectionable, but when turning it is right in the line of vision. The merit of this large front glass is well understood and the reason that it is not more in use is because the slant line of the front renders it troublesome to lower and raise; besides, it must either be all the way up or all the way down, having no intermediate position. Some few make it stationary, but this is not necessary, as it

can be lowered by having the front member that forms the angle glass frame extend below the hook channel about 3 in. This will always be engaged in the runway and will be sufficient guide for the up and down movement of the glass. When down the top of this front side member will wedge slightly between the bar and the lining board and keep it from rattling. This is the cheapest and most satisfactory and it works well in practice. The design, however, entails the use of central doors. By making the right front seat so it can be easily rocked forward, crowding of the rear compartment can be obviated.

Fig. 3 shows another model which can be as low, compact and light as the size of the persons using it will permit. For small people the height can be shaded down 3 in. and the length reduced considerably more than this. However, in reducing the length, care should be used that the window spaces remain of nearly equal size as this makes a better proportioned job. The single permanent line that cannot be altered is the rear line of the door. This must be kept as far back as illustrated, because the door when open is forward of the rear cut by a distance nearly equal to its own thickness, and sufficient clear space must be provided to pass the door and get back of the front seat top.

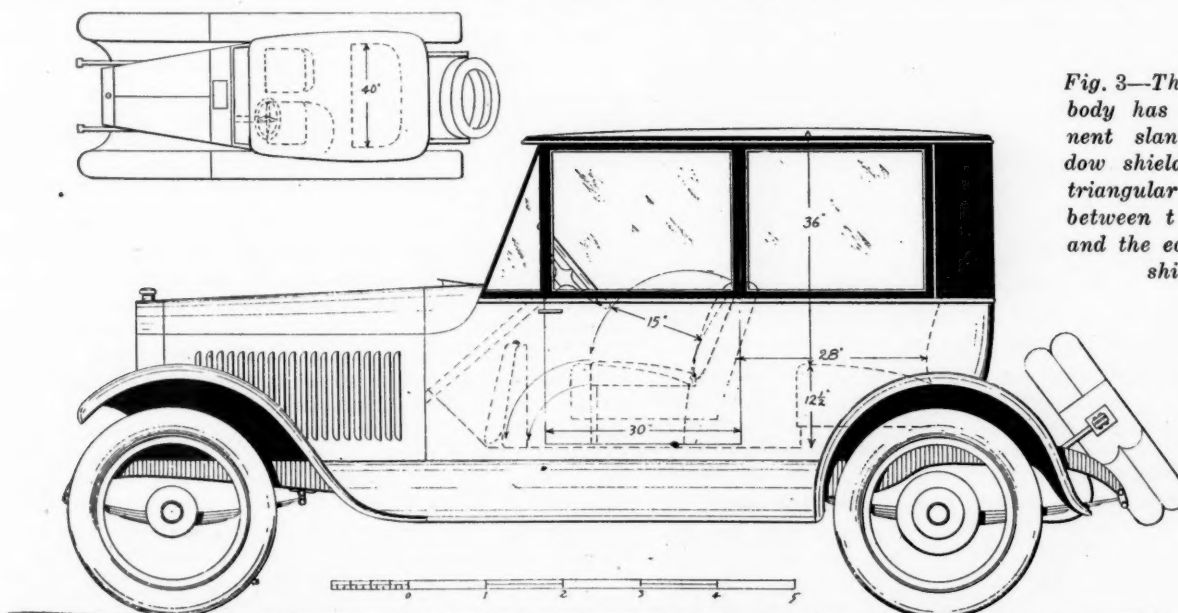


Fig. 3—This inclosed body has a permanent slanting window shield, with a triangular window between the door and the edge of the shield

# British Adopt Twenty Standard Steel Specifications

Cover the Whole Range of Steels Used in Automotive Engineering—Both  
Chemical and Physical Properties Specified—  
Definitions of Terms Used

LONDON, Jan. 15—Twenty steel specifications specially written for automobile users and known as the British standard automobile steels have been adopted, and production has already started upon them. The twenty cover the complete gamut of automobile steels and represent the consensus of opinion of the steel makers, as well as the automobile makers, on what is needed for the automobile industry.

Research work was pushed ahead at a maximum pace by the steel makers, and within 11 months of the start of the research the steel makers were in production on most of the twenty grades.

The Institution of Automobile Engineers, which represented the automobile industry in this work, thinks it has a superior class of specifications to those adopted by the Society of Automotive Engineers, and looks to the S. A. E. to revise its list in accordance with the British ones.

The specifications for the British automobile steels have been agreed upon and declared standards by the British Engineering Standards Committee, which means that they are the official British standards and cannot be altered without the action of the B. E. S. C.

The specifications and tests of the British steels are:

## E. S. C. 10 CARBON CASE HARDENING STEEL

Carbon .....0.08 to 0.14 per cent  
Silicon .....Not over 0.20 per cent  
Manganese .....Not over 0.60 per cent  
Sulphur .....Not over 0.04 per cent  
Phosphorus .....Not over 0.04 per cent

This steel, when normalized at 900° C. to 920° C., shall pass in every particular the following check tests:

Tensile breaking strength.....23 to 28 tons per sq. in.  
Yield ratio .....Not less than 50 per cent  
Elongation .....Not less than 30 per cent  
Reduction of area.....Not less than 50 per cent

It shall show a Brinell hardness test between Nos. 92 to 112.

## E. S. C. 15 CARBON FOR CASE HARDENING STEEL

Carbon .....0.12 to 0.20 per cent  
Silicon .....Not over 0.20 per cent  
Manganese .....0.65 to 1 per cent  
Sulphur .....Not over 0.07 per cent  
Phosphorus .....Not over 0.07 per cent

In check test, when normalized at 890° C. to 920° C., it shall pass in every particular the following test:

Tensile breaking strength.....25 to 33 tons per sq. in.  
Yield ratio .....Not less than 50 per cent  
Elongation .....Not less than 28 per cent  
Reduction of area.....Not less than 50 per cent  
Brinell hardness test.....Nos. 103 to 143

## E. S. C. 2 PER CENT NICKEL CASE HARDENING STEEL

Carbon .....0.10 to 0.15 per cent  
Silicon .....Not over 0.30 per cent  
Manganese .....0.25 to 0.50 per cent  
Sulphur .....Not over 0.05 per cent

Phosphorus .....Not over 0.05 per cent  
Nickel .....2 to 2.50 per cent

In check test, when normalized at 850° C. to 900° C., it shall pass in every particular the following test:

Tensile breaking strength.....25 to 35 tons per sq. in.  
Yield ratio .....Not less than 55 per cent  
Elongation .....Not less than 30 per cent  
Reduction of area.....Not less than 55 per cent  
Brinell hardness .....Between Nos. 103 and 153

## E. S. C. 5 PER CENT NICKEL CASE HARDENING STEEL

Carbon .....Not over 0.15 per cent  
Silicon .....Not over 0.20 per cent  
Manganese .....Not over 0.40 per cent  
Sulphur .....Not over 0.05 per cent  
Phosphorus .....Not over 0.05 per cent

In check test, when normalized at 820° C. to 860° C., it must pass in every particular the following test:

Tensile breaking strength.....25 to 40 tons per sq. in.  
Yield ratio .....Not less than 60 per cent  
Elongation .....Not less than 30 per cent  
Reduction of area.....Not less than 55 per cent  
Brinell hardness test .....Nos. 103 to 179

## E. S. C. 20 CARBON STEEL

Carbon .....0.15 to 0.25 per cent  
Silicon .....Not over 0.25 per cent  
Manganese .....0.40 to 0.85 per cent  
Sulphur .....Not over 0.06 per cent  
Phosphorus .....Not over 0.06 per cent

In check test, after normalizing at 890° C. to 920° C., this steel shall in all particulars meet the following test:

Tensile breaking strength.....26 to 34 tons per sq. in.  
Yield ratio .....Not less than 50 per cent  
Elongation .....Not less than 28 per cent  
Reduction of area.....Not less than 50 per cent  
Brinell hardness .....Nos. 105 to 149

## E. S. C. 35 CARBON STEEL

Carbon .....0.30 to 0.40 per cent  
Silicon .....Not over 0.30 per cent  
Manganese .....0.50 to 0.85 per cent  
Sulphur .....Not over 0.06 per cent  
Phosphorus .....Not over 0.06 per cent

In check test, when normalized at 850° C. to 880° C., this steel shall in all particulars meet the following requirements:

Tensile breaking strength.....30 to 40 tons per sq. in.  
Yield ratio .....Not less than 50 per cent  
Elongation .....Not less than 25 per cent  
Reduction of area.....Not less than 45 per cent  
Brinell hardness .....Nos. 121 to 179

## E. S. C. 3 PER CENT NICKEL STEEL

Carbon .....0.25 to 0.35 per cent  
Silicon .....Not over 0.30 per cent  
Manganese .....0.35 to 0.75 per cent  
Sulphur .....Not over 0.04 per cent  
Phosphorus .....Not over 0.04 per cent  
Nickel .....2.75 to 3.50 per cent

In check test this steel shall in every particular meet the following requirements when normalized at 840° C. to 880° C.:

Tensile breaking strength.....	35 to 45 tons per sq. in.
Yield ratio .....	Not less than 55 per cent
Elongation .....	Not less than 24 per cent
Reduction of area.....	Not less than 45 per cent
Brinell hardness .....	Nos. 140 to '202

## E. S. C. 1½ PER CENT NICKEL-CHROMIUM STEEL

Carbon .....	0.25 to 0.35 per cent
Silicon .....	Not over 0.30 per cent
Manganese .....	0.35 to 0.60 per cent
Sulphur .....	Not over 0.04 per cent
Phosphorus .....	Not over 0.04 per cent
Nickel .....	1.25 to 1.75 per cent
Chromium .....	0.75 to 1.25 per cent

In check test this steel, oil hardened at 850° C. and tempered at 600° C., shall meet the following requirements in every particular:

Tensile breaking strength....	Not less than 45 tons per sq. in.
Yield ratio .....	Not less than 70 per cent
Elongation .....	Not less than 15 per cent
Reduction of area.....	Not less than 50 per cent
Brinell hardness .....	Approximately 179

## E. S. C. 3 PER CENT NICKEL-CHROME STEEL

Carbon .....	0.20 to 0.30 per cent
Silicon .....	Not over 0.30 per cent
Manganese .....	0.35 to 0.60 per cent
Sulphur .....	Not over 0.04 per cent
Phosphorus .....	Not over 0.04 per cent
Nickel .....	2.75 to 3.50 per cent
Chromium .....	0.45 to 0.75 per cent

In check test this steel, when oil hardened at 820° C. and tempered at 600° C., shall meet the following requirements in every particular:

Tensile breaking strength.....	45 tons per sq. in.
Yield ratio .....	Not less than 75 per cent
Elongation .....	Not less than 15 per cent
Reduction of area.....	Not less than 20 per cent
Brinell hardness .....	Approximately 179

## AIR-HARDENING NICKEL-CHROME STEEL

Carbon .....	0.28 to 0.36 per cent
Silicon .....	Not over 0.30 per cent

Manganese .....	0.35 to 0.60 per cent
Sulphur .....	Not over 0.04 per cent
Phosphorous .....	Not over 0.04 per cent
Nickel .....	3.50 to 4.50 per cent
Chromium .....	1.25 to 1.75 per cent

In check test this steel, air hardened at 820° C., shall meet the following requirements in every particular:

Tensile breaking strength....	Not less than 100 tons per sq. in.
Yield ratio .....	Not less than 75 per cent
Elongation .....	Not less than 5 per cent
Reduction of area.....	Not less than 13 per cent
Brinell hardness .....	Approximately 418

A series of definitions with regard to different processes in steel manufacture as follows were also agreed upon:

**Normalizing**—Means heating a steel to a temperature exceeding its upper critical range and allowing it to cool freely in the air.

**Annealing**—Means reheating, followed by slow cooling.

(a) It is to remove internal stresses and to induce softness.

(b) It is to refine crystalline structure.

**Hardening**—Means heating a steel to its normalizing temperature and cooling more or less rapidly in water, oil or air.

**Tempering**—Means heating a steel to a temperature not exceeding its carbon change point so as to reduce hardness or increase toughness.

**Cementing**—Means heating a steel above its normalizing temperature in a medium which will increase the carbon content.

**Core**—The core of a case hardened bar is the interior portion which is substantially unaffected in composition by the cementing process.

**Refining**—Means reheating a steel to its normalizing temperature and is usually followed by quenching.

**Tensile Breaking Strength**—Means the greatest load sustained by a test piece expressed in tons per square inch of the original area of the test piece.

**Yield Ratio**—Means the ratio between yield stress and tensile breaking strength.

**Reduction of Area**—Reduction of area in per cent is the difference between the original and fractured areas expressed in percentage of the original area.

## Cellon Insulating Varnishes

RECENT inquiries instigated by the German Ministry of Raw Materials have shown that both satisfactory and unsatisfactory results have been obtained in the use of cellon varnishes for insulating parts of electrical conductors and machines. This led the editor of the *Elektrotechnische Zeitschrift* to request Dr. A. Eichengrün of the Cellon Laboratory, Charlottenburg, to prepare a report on the experience he has gained, embodying his views on the causes of the troubles that have been met.

In the report it is pointed out that cellon varnishes should not be regarded as a "substitute" for oil varnishes, but that they constitute an entirely new and valuable insulating material with special properties. Cellon varnishes should be used only under particular conditions, and the choice of the correct variety is of the greatest importance. In contrast with oil varnishes that are absorbed and held by carriers such as cotton or silk coverings and require oxidizing by baking, cellon varnishes form solid coatings on bare metal by the evaporation of the liquid forming the cellon solution, no oven drying or oxidation in the air being required. Cellon varnishes are particularly suitable for insulating bare conductors, such as overhead conductors and bus-bars; sealing up cable ends; covering parts of machines, such as armature leads; forming protective coverings on wood or metal parts, such as handles, levers, hand wheels, etc.

Cellon varnishes are classified under 7 headings: (a) thin flowing and quick drying, to be painted on with a brush; (b) very thin flowing for squirting by a vaporizer; (c) concentrated and thick, to be applied by dipping the article to be covered; (d) impregnating varnishes to be absorbed by fabrics and the coverings of wires; (e) thick foundation

varnishes to serve as a support for the cellon insulating varnishes; (f) thick pastes hardly suitable for electrical purposes; (g) cements for filling holes or forming very thick protective coverings. The layers of cellon obtained from varnishes vary from very hard and inflexible to very soft and pliable. The hardest kinds are the best insulators. In many cases the softer kinds are applied at first and then covered with a coating of a harder kind. All the varnishes adhere well to paper, fabrics and rough wood surfaces, but poorly to metal, stone, cement, etc. They are obtainable in a variety of colors. As the solution has to be made at the present time with liquids of questionable purity it is safer to use only the absolutely neutral varieties for application to copper. Hard varnishes withstand temperatures up to 200° C., but the soft ones soften at 70° C. A number of hints are given as to the choice of varnishes for particular purposes and the methods of applying them.

PREVIOUS to the war Austria did not produce any motor plows, but now this industry has been started in Bohemia and a large trade with the East, chiefly Russia, is being looked forward to. Agricultural machinery of other kinds is also to be manufactured. The prospects of these industries depend largely on the supply of iron and coal. Just now there is a great scarcity of iron, and applications for the release of that metal for the purpose of machinery export have been in most cases refused. The continual deterioration of the coal supply makes it likely that in the coming months the machine industry will also suffer from lack of fuel.

# FUEL

## Mexico as Source of Petroleum and Its Products\*

Holds Second Place Among Petroleum Producing Countries of the World—U. S. Best Market—Development Since 1910 Has Been Tremendous

By R. De Golyer

MEXICO, with its production of approximately 67,000,000 bbl. in 1918, apparently achieved second place among the petroleum-producing nations of the world. The United States, with a marked production of some 345,000,000 bbl., was secure in first place, but it is certain that revolution-ridden Russia could not have produced enough of its normal 60,000,000 to 70,000,000 bbl. to enable it to retain second place.

This position, now gained by Mexico, will not soon be relinquished. The potential production since 1911, the year in which Mexico became an exporter of petroleum, has been far in excess of the actual production, which in the past few years has been limited by the serious tank steamer shortage resulting from the great war. With the ending of the war, the tankers are being rapidly released and many of them are going into the Mexican trade. Production for the present year is likely to be greatly in excess of that of 1918.

There are two general regions in Mexico from which petroleum has been produced—the highly important Tampico-Tuxpam region and the less explored Tehuantepec-Tabasco region. The Tampico-Tuxpam region, which includes the section of the Gulf coastal plain adjoining the ports of Tampico and Tuxpam, is the region from which practically the entire commercial production of Mexico comes at the present time.

The fields of the Tampico-Tuxpam region are divided generally into two groups—those of the Panuco River valley region and those of the southern or Tuxpam region. The fields of the Panuco River valley region, including the Panuco, Ebano-Chijol, and Topila pools, produce heavy viscous petroleum of 10 to 13 deg. Baumé gravity which are used principally in their crude state as fuel oils. The fields of the Tuxpam zone, including Potrero del Llano, Casiano-Tepetate, Cerro Azul, Los Naranjos, Alamo, and Furbero pools, produce lighter petroleum of 19 to 22 deg. Baumé gravity which are the Mexican petroleum used generally for refining purposes.

### Export Trade With the United States

Approximately 69 per cent of the petroleum produced in Mexico in 1917, the last year for which detailed statistics are as yet available, was of this grade, and 31 per cent was of the heavier Panuco grade. The proportion of the lighter crude was probably even greater in the production of the past year. Of the 1917 Mexican petroleum production, some 77.6 per cent was exported. Exports for the past year show an even greater percentage and will increase as the Mexican production increases. Of the petroleum remaining in the country during 1917, the equivalent of 5.2 per cent of the total production represents fuel consumed by the Mexican railways and 1.5 per cent represents petroleum consumed principally as fuel in the industry itself. The remaining 15.5 per cent of the total production includes petroleum and products consumed in Mexico, refining losses, increase in storage, if any, etc.

The United States is the greatest single market for Mexican petroleum. In spite of limited transportation facilities during 1917 because of tanker shortage, the United States took petroleum and products from Mexico equal to 65.9 per cent of its entire production. Other nations took 11.7 per

cent. The imports of crude petroleum, distillates, and various refined products from Mexico to the United States during that year were equal to more than 10 per cent of the entire production of the United States in its banner year, the one just past.

The benefits resulting from this condition are reciprocal. The United States profits by getting the petroleum, and Mexico, by the nearness of a great market where, as a result of experience acquired from the utilization of its own immense petroleum supplies, American industries are accustomed to the use of petroleum and its products to an extent not equaled in any other country of the world.

### Mexican Capacity 1,000,000 Bbl. Per Day

It has been noted that the potential production of Mexico is far in excess of its actual production. It is estimated that the total capacity of wells already completed in Mexico is more than 1,000,000 bbl. per day. In other words, if the petroleum could be taken care of, so that all the wells could be opened at once, the rate of production would be some eight to ten times the actual present rate. This potential production is slightly greater than the present actual production of the United States. The comparison is likely to mislead, however, unless it is remembered that the production of the United States is an actual proved production and can be maintained for some time by drilling up proved areas, whereas to maintain the actual production of Mexico for a year at its potential capacity would undoubtedly require the discovery of new fields.

We have been so impressed by the unprecedented size of some of the Mexican gushers and by their continued production of large quantities of petroleum over long periods of time without any appreciable decline in amount of petroleum produced daily or in field pressures that we have perhaps overestimated the total amount of petroleum to be secured from any single pool. The explanation of the great gushers seems to lie in the very great porosity of the rock in which the petroleum occurs. It collects in a network of caves and channels previously dissolved out of a bed of very thick limestone by the action of water. This condition allows the petroleum to move about very freely while still underground. Furthermore, the petroleum generally lies over water under an artesian head and as a consequence the field pressure is largely hydrostatic rather than gas pressure, which in most oil fields is the expulsive force causing the oil to flow. Effectively, the result of these conditions seems to be that in Mexico there are deposits of petroleum which can be exhausted with a single well, whereas a deposit of the same size under different conditions of occurrence would require hundreds if not thousands of wells to exhaust it. For comparative purposes it might be noted that there are two wells in Mexico, Potrero del Llano No. 4 and Juan Casiano No. 7, either of which has produced more petroleum than any single field along the Gulf Coast of the United States, while the production of the biggest fields of the Gulf Coast has come from hundreds, if not thousands, of wells, in each instance. The gusher condition in Mexico seems to indicate ease in exploiting rather than such abnormally large pools as have been inferred from the great size of the gushers encountered.

Until 1910, both the actual and potential production of

\*Read at the winter meeting of the S. A. E., New York, Feb. 4-6.

Mexico were almost insignificant, in fact not great enough to supply the domestic trade of Mexico itself. Petroleum was imported from the United States and refined at the Minatitlan plant of the Mexican Eagle Oil Co. and the Tampico plant of the Waters-Pierce Oil Co. Small amounts of petroleum were produced at Furbero and in the Isthmus of Tehuantepec and refined by the Mexican Eagle Oil Co. at Minatitlan. A small amount of very heavy petroleum produced at Ebano by the Mexican Petroleum Co. was being topped in a small field plant. The distillate was sent to the Tampico refinery for further treatment and the residue made into asphalt or used as fuel on the Mexican railways. The highly important Dos Bocas and Casiano fields had been discovered, but Dos Bocas had been lost by fire and the discovery wells in the Casiano field had fallen off in production until there was some doubt whether they would be able to supply enough petroleum to run the pipe line then under construction to Tampico.

During 1910, however, the Potrero and Tanhujio fields were discovered and Potrero No. 4, which has since produced more than 100,000,000 bbl. of petroleum, was brought in. Juan Casiano No. 7, with a record second only to that of Potrero No. 4, was completed and the discovery well in the Panuco field was brought in.

#### Production Far Exceeds Consumption

The potential production of Mexico thus became so great that she had petroleum far in excess of her own requirements—far in excess of the capacity of transportation systems reaching tidewater and thus making the petroleum available for export. This condition has been permanent since that time, so that to-day the developed production of Mexico is greater than can be carried to tidewater by her rapidly developing pipe-line systems or river-barging equipment. Even if the entire present production could be got to tidewater, it is doubtful whether there are enough ships available to distribute it to the world markets or whether the markets could immediately absorb it. Great fleets of tank steamers to carry Mexican petroleum have been built by the Eagle Transport Co., Ltd., (British), and the Petroleum Transport Co. (American), controlled by the Pearson and Doheny interests respectively, the foremost producers of Mexican petroleum.

The members of this Society are doubtless particularly interested in estimates of the future petroleum supply which can be expected to come from Mexico. The future of supply rather than the past is of greater interest to prospective consumers.

#### Estimate Production on Past Performance

Estimating petroleum reserves is under the best of conditions a somewhat uncertain business. There was the old method of calculating the oil content of a field or property from the thickness and porosity of the oil-bearing rock. The estimate so secured was modified by a safety factor of 20 to 50 per cent to cover petroleum which could not be mined, and on the resultant guess was based the best estimate as to petroleum reserves. The correctness of such a form of estimate depends largely upon a felicitous selection of the safety factor.

We do a little better now perhaps by estimating the probable production of wells to be drilled or the reserve remaining in wells already producing by comparison with the production of average wells in the same or similar fields. Such a study involves the construction of production curves, the various points on a curve being determined by plotting the amounts produced from a single well or an average well as the ordinates, with the fixed units of time in which produced, arranged consecutively, as the abscissas. Data for the construction of such a graph, to be of any value, must show the changes in the amount of unrestricted production of a given well or average well during various units of time.

We can make estimates of reserves in the Mexican fields by neither method. We have no data as to thickness or porosity of the petroleum-producing formations and consequently cannot use the volumetric method. The bulk of petroleum from Mexico has come from wells of such size that only

the production from a restricted flow could be utilized. Production curves constructed on such artificially restricted data as are available under these conditions would be almost valueless. Nevertheless, we can make a rough guess as to the fields already producing in Mexico. It seems fair to assume, on the basis of past performances, that the fields already producing in Mexico indicate what one might call a blocked-out reserve of from a half billion to a billion barrels of crude petroleum.

Geologic conditions indicate that other petroleum fields of greater importance than those now known will yet be discovered in Mexico. So far as exploratory drilling is concerned, the petroleum regions have been but scratched. Not more than 1000 wells have been drilled in all of Mexico since the earliest attempt to discover petroleum. Included in this are a great number of wells drilled for exploitation purposes in fields already discovered, and a number of wells drilled in Tabasco, the Isthmus of Tehuantepec region and various outlying regions.

#### High Average Well Output

Remarkably few wells are being drilled in Mexico when one considers the amount of petroleum produced. According to official statistics, seventy-nine wells were drilled in 1917, and of them forty-three were productive with an estimated initial output of 235,027 bbl., and thirty-six were dry holes and abandoned. Bardone of the *Oil and Gas Journal* estimates that twenty-three wells were completed in the first half of 1918, twelve of them being producers, with an estimated initial production of 350,000 bbl. For comparative purposes, it might be noted that 1117 wells were completed in Kansas and Oklahoma in the single month of July, 1918. These successful wells have been in proved pools with the single exception of Molina No. 2, which was drilled during the latter part of 1917 and which was the discovery well of a new field.

The greatest needs of the Mexican petroleum industry at the present time are some relief from the continually increasing taxes, which are apparently designed to be confiscatory, and some degree of safety in the petroleum-producing regions in order that much needed drilling of an exploratory nature may be carried on.

The use of Mexican crude petroleum in internal-combustion engines has not yet passed beyond the experimental stage, but more and more crude petroleum is being refined for its light oil products, and this forms an increasingly important addition to the world's supply of engine fuel. The Mexican Eagle Oil Co., Ltd., has refineries at Minatitlan and Tampico and a topping plant at Tuxpam. The Waters-Pierce Oil Co. has refineries at Vera Cruz and Tampico. The Standard Oil Co. of New Jersey has a refinery at Tampico. The Texas Co. has topping plants at Port Lobos and Tampico. The Doheny interests have a topping plant at Tampico and an asphalt plant at Ebano. The Atlantic Refining Co. has a topping plant at Port Lobos.

#### Little Real Help from Mexico

Only the 19 to 20 deg. Baumé petroleum of the Tuxpam region are refined in quantity in Mexico. All of the refineries and topping plants run it except the Tampico plant of the Texas Co., which tops some Panuco crude, the Ebano asphalt plant, which runs Ebano crude, and the Tampico refinery of the Waters-Pierce Oil Co., which runs a very small amount of Topila crude besides much greater amounts of Tepetate-Casiano, Naranjos and Potrero crudes.

Panuco crude is used mostly for fuel purposes. It is so viscous that after the very small light oil fraction has been removed, the residue can be handled only with the greatest difficulty and by specially designed equipment. Panuco crude is imported to the United States and, after being mixed with Gulf Coast crudes, is successfully refined. One American refinery is reported to crack Panuco crude, thus securing 12 to 16 per cent of gasoline or engine fuel.

The greatest possibilities for future extended uses of Mexican petroleum seem to lie either in the further perfection and more widespread development of internal-combustion engines using very heavy oils as fuel, or in an improvement of refining methods by which heavy oils can be more easily con-

verted into lighter oil. It is likely that both methods will be utilized. In the past several years the continued development and widespread use of internal-combustion engines have created such a demand for fuel that it has been supplied only by great efforts on the part of the producer and refiner of petroleum. Fortunately for the petroleum industry, this demand has set the mark and the internal-combustion engine has not waited to be assured of a source of supply for a fixed number of years in advance.

As to the great advantage of the use of Mexican petroleum in internal-combustion engines over its use as fuel for boiler installations there can be no doubt. In this connection, one can hardly do better than quote from a recent paper by Lord Cowdray, head of the Mexican Eagle Oil Co., Ltd., and affiliated organizations:

#### Lord Cowdray's Opinion

"It should be stated that Mexican oil, especially refined for use in Diesel engines, is now available for motorships. It is possible that the subject of internal-combustion engines for ships has been discussed with an excess of optimism and led to expectations that have not yet been fully realized, but the most conservative observer cannot fail to be impressed by the solid progress already made in this direction, and the utility of the oil engine for moderate-sized vessels seems to be soundly established. The primary advantage is disclosed in the following figures, giving approximately the comparative consumption by main and auxiliary machinery for various types of marine propulsion.

"It will be seen that the oil engine can claim the lowest consumption; the vessel's radius is considerably increased. These are factors which will inevitably insure a great future for motorships, and the provision of fuel supplies on an ample scale will accelerate their progress."

	Lb. of fuel per hp.-hr.
Steam engine, coal-fired .....	1.60
Steam turbine, coal-fired .....	1.30
Steam engine, oil-fired .....	1.00
Steam turbine, oil-fired .....	0.82
Oil engines .....	0.50

Statistics covering the production of petroleum by years since the beginning of the industry have recently been made public by the Petroleum Commission of the Mexican Government. They show the past history of Mexican petroleum and indicate prospects for future increases in production better than can be done in any other manner.

Year	Bbl.	Metric tons
1901 .....	10,345	1,544
1902 .....	40,200	6,000
1903 .....	75,375	11,250
1904 .....	125,625	18,750
1905 .....	251,250	37,500
1906 .....	502,500	75,000
1907 .....	1,005,000	150,000
1908 .....	3,932,900	587,000
1909 .....	2,713,500	405,000
1910 .....	3,634,080	542,400
1911 .....	12,552,798	1,873,552
1912 .....	16,558,215	2,471,375
1913 .....	25,696,291	3,835,267
1914 .....	26,235,403	3,915,732
1915 .....	32,910,508	4,912,016
1916 .....	40,545,712	6,059,589
1917 .....	55,292,770	8,264,266
1918 (estimated) .....	67,000,000	10,000,000
Total .....	289,082,472	43,166,241

## 90-95% Lubricating Oil Reclaimed by Army Emergency Process

### Complete Gasoline and Oil Consumption Records of Allies

240,000 gal. gasoline used per day by French army.

500 gal. gasoline used per month for airplanes—average, 1 hour per day.

.572 lb. per horsepower hour for airplane.

8 miles per gallon gasoline for staff cars—average, 190 miles per day.

6 miles per gallon gasoline for truck—average, 100 miles per day.

### War-Time Necessity Brings About Peace-Time Saving of Fuel

By W. F. Bradley

**D**URING the month of October, 1918, the Allied armies in France consumed 34,100,000 gal. of gasoline. This was divided among the three nations as follows: France, 14,600,000 gal., England 12,000,000 gal., America 2,500,000 gal. Immediately after the signing of the armistice the gasoline consumption increased owing to the lengthening of the lines of communication. The French army, for instance, consumed 16,860,000 gal. of gasoline during the month of November.

The gasoline consumption of France has steadily increased since 1914. Official figures just issued show that the consumption of gasoline and kerosene for the last 5 years was as follows:

	Gallons
1914 .....	178,500,000
1915 .....	171,400,000
1916 .....	240,000,000
1917 .....	228,700,000
1918 .....	365,400,000

The above figures cover the total consumption of France for both military and civilian uses. Most of the gasoline and kerosene supplied for so-called civilian purposes was used either directly or indirectly for military objects.

For the last three years, 1916, 1917, 1918, no gasoline has been sold to persons not engaged in some military work. For civilian passenger-car service the maximum

allowance of gasoline was a little less than 3 gal. per day, and this amount was only granted to persons using a car in the interests of the nation.

Toward the end of 1917, when the gasoline crisis was at its height, the French military authorities adopted a system of rationing for the army. The officer in charge of each automobile unit was supplied with a limited number of checks which enabled him to draw gasoline from one of the supply depots. In any given period he could not draw more than the quantity of gasoline indicated on his checks. In an army consuming nearly 240,000 gal. of gasoline per day this system resulted in considerable economies.

Although the gasoline shortage in France has frequently been acute, and the strictest economy had to be observed, it is declared that the army was never at any moment handicapped by a shortage of gasoline for its trucks, tanks, passenger cars, tractors, and airplanes.

#### Army Records of Gas Consumption

French automobile authorities have kept careful records of the gas consumption of all kinds of trucks. Possessing this data, they have found it advisable on several occasions to order a change of carbureter. These records showed, too, where any section or truck train was consuming more than similar groups.

In the aviation service the limit of gasoline and oil consumption was 0.572 lb. per horsepower hour. If this could not be obtained during the official tests the engine was refused. In the American army it was generally estimated that the average consumption of gasoline by an airplane was 500 American gal. per month. This average was based on a general service of both scout and bombing machines.

The French army authorities estimate that staff cars consume gasoline at the rate of 8 miles to the American gallon, and that these cars average 190 miles per day. The average for trucks is 6 miles to the gallon, and the mileage is estimated at 100 per day. In estimating the consumption of gas for airplane squadrons it is assumed that every engine runs for one hour each day.

Practically all the gasoline used in France during the war came from America, and was carried in either American or British tank steamers. The three most important ports at which gasoline was received were La Palice, Le Havre and Bordeaux. Dock facilities were soon found insufficient, and important extensions had to be made.

France was also short of tank wagons when war was declared, the total number at that time being only 470. This number was quickly increased to 680, then to 835. Important orders for tank wagons have been placed in England and America, with the result that France will soon possess 1500, and within a very short time will have a total of 2500 in service, for Germany is obliged to deliver 1000 tankers among the 150,000 railroad cars stipulated in the armistice agreements.

#### Gasoline Distributed in Cans

The final distribution of gasoline in France, in both military and civilian circles, is in cans containing 1 1/3 gal. Tank distribution by a pump and measuring instruments is practically unknown. Within a few months of the declaration of war, gasoline cans became scarce. Private owners stored cans wherever they could, for they were unable to get deliveries of gasoline if they did not present empty cans in exchange for full ones. At the front, the life of a gasoline can was very short. Because of the rapid destruction of the small cans the automobile service of the army adopted the use of the 13-gal. cans which already existed in the trade, and practically every truck carried one of these cans in reserve within special brackets built on the running board.

The American army kept its main supply of gasoline and oil at the intermediate supply depot established at Gièvras, half way up the lines of communication. This depot, which was entrusted with the task of supplying gasoline to the advance sections, had a reserve of four tanks, each tank containing 500,000 gal. of gasoline. This fuel was handled by the Quartermaster Corps, which distributed it to the Motor Transport Corps, the Air Service Engineers, artillery, and others having need of it.

#### Aviation Program Threatened Oil Shortage

Early in the war the development of the aviation program threatened to cause an oil shortage. One very wise precaution taken by the French Government was to monopolize all castor beans brought to France. These were delivered to the oil mills at 50 cents per pound. By reason of this measure very little castor oil got to the open market, but where a supply was obtained the usual price was from \$1 to \$1.50 per pound.

Early in 1916 a chemist attached to one of the States Laboratories discovered a process by which castor oil could be filtered and refined in order to render it fit for further service in aviation motors. This process was brought to the attention of the States Aviation authorities, who refused to be interested. Somewhat discouraged, the inventor brought his process to the notice of M. Meurisse, a press photographer, who for a number of years had acted as AUTOMOTIVE INDUSTRIES representative in France.

M. Meurisse, being acquainted with all the automobile manufacturers, endeavored to secure used oil from them in order to treat it by this process. Merely as a personal favor, and without any hope that the oil would be regenerated, one of the manufacturers delivered 300 gal. of used castor oil to him.

This was refined in accordance with the process invented by the chemist, returned to the factory, and used in an engine undergoing its 50-hour test at full load. Judging from the state of the engine after this test, the regenerated castor oil was equal to new.

#### Castor Oil Reclaimed

Aviation engine manufacturers were soon convinced that this process was to their advantage, and measures were taken to collect all used castor oil and send it to the factory created by M. Meurisse for treatment. In less than one year practically all the aviation engine manufacturers in the Paris district were sending used oil to be reclaimed.

The Gnome Co., for instance, fitted oil collectors around their engine test benchstands, so that all the oil thrown out of the exhaust could be collected.

Renault was one of the biggest users of this process. He gave orders that the base chambers of aviation engines should be emptied after two hours running under full load and that the oil thus obtained should be sent out for treatment. As the cost of this process was only 7 1/2 cents per gallon, a real economy was effected.

The practice of using oil to destruction, previously done, was risky, for it sometimes happened that an oil was used too long and bearings were burned out in consequence. By giving orders that no oil should be used for more than two hours' steady running all danger of burned-out bearings was eliminated.

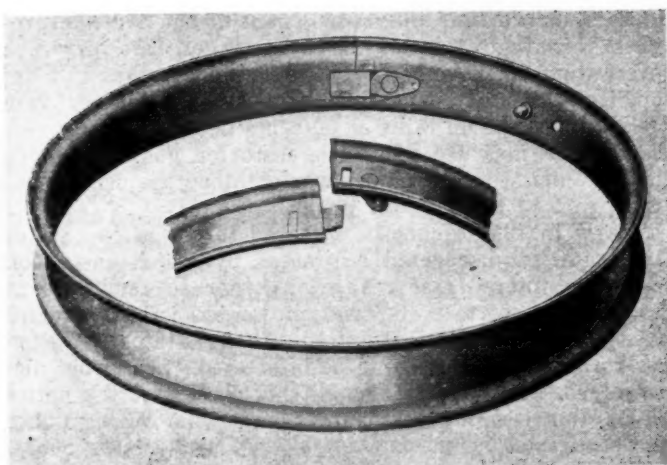
In all, about 53,700 gal. of castor oil were treated by this process during the war for the Renault Co. Other firms adopting this process were Hispano-Suiza, Clerget, Darracq, Brazier, Clément-Bayard and Mayen.

After this regenerating process had been adopted by the manufacturers the army became interested. A gen-

(Continued on page 450)

## New Stanweld No. 76 Rim

Cam Locking Device Retained—New Design in Accord with Recently Adopted Rim Standards—Large Wedges Insure Proper Alignment of Rims



No. 76 Stanweld rim, which conforms to S. A. E. standards

### Farm Tractors in France

ACCORDING to an article in *La Technique Modern*, the farm tractor tests held at La Verriere and Mesnil-Saint Denis (Seine et Oise) last September once again drew attention to the desirability of increasing the cultivation of the soil by means of tractors and of developing the manufacture of such tractors. This article describes the machines of French construction.

Power farming is very necessary in France, owing to the low birth-rate, the constant migration from the country to the towns, and the serious diminution of labor caused by the war. A table is given showing the results obtained in tests made before 1913 and others carried out between 1913 and 1917. The summary of these shows that the average resistance of the soil to a turning effort is as follows:

For light soils, 45 kg. per square decimeter; for average soils, 55 kg.; and for heavy soils, 70 kg. This corresponds to 6.4, 7.8 and 10 lb. per square inch. From the tabulated figures the author deduces that the share of a plow turning a furrow 0.33 x 0.18 m. (13 x 7.1 in.) in section will require a mean tractive effort on the plow of 270 kg. (594 lb.) for light soils; 330 kg. (726 lb.) for average soils; and 420 kg. (924 lb.) for heavy soils. Experience with foreign tractors, especially American, although they have given extremely valuable results in war time, has clearly shown that they are not well adapted for work upon French farms, and French tractors rationally constructed to suit the local conditions should give much better results the author says.

### Benzol in Great Britain

A NATIONAL BENZOL ASSOCIATION has been formed in Great Britain to encourage the use and organize the distribution of benzol as a motor fuel and for other industrial purposes. Among the objects of the association are the following: (a) To interest automobile users and others in benzol as a motor fuel; (b) to sell and distribute motor benzol, whether wholesale or retail, and to obtain for it a fair market price; (c) to standardize motor benzol, and to carry on, assist and promote investigation and research with a view to its improvement. The association is to consist of motor benzol producers whose businesses are situated in the British Isles and are subscribers to the association.

A NEW standardized rim, referred to as the No. 76, has just been announced by the Standard Parts Co., Cleveland, Ohio. This rim has been designed in conformity with recently adopted rim standards and besides embodies features which are exclusive with the Standard Parts Co. One of the features for which considerable importance is claimed is that the valve stem hole is quite a distance from the split, which prevents injury to the stem when the rim is being manipulated.

No change has been made in the cam locking device, which has long been a feature of Stanweld rims. This locking device is claimed to be thoroughly efficient and easily operated, though it is exceptionally simple in construction.

The wedges holding the rim in place have a large bearing surface, which tends to keep the rims in proper alignment on the wheel and to prevent unnecessary wear of tires. Another advantage resulting from the large bearing surface of the wedges is that the annoying squeaking of rims is entirely eliminated. The wedge nuts are self contained, which simplifies the removal and application of the rims and prevents loss or misplacing of the nuts. The rims are claimed to be exceptionally light and strong.

### Castor Beans in Central America

THE extraordinary demand in the United States a few months ago for castor oil as an engine lubricant created a great deal of interest throughout Central America, where the climate and soil are well suited to the production of castor beans, according to a trade report received here.

A considerable number of plants grow wild in a few places, notably Antigua in Guatemala. This wild production had been utilized in past years by pressing out small quantities of oil for local consumption. In Salvador, Nicaragua, and Costa Rica many planters decided to take up the cultivation of the castor bean in a systematic way, and several of them entered into contracts with importers in the United States for the year's crop.

In Nicaragua two large contracts were signed, aggregating 126,000 bushels. The total crop in that country will probably be about 200,000 bushels. The Nicaraguan crop was planted at the beginning of the rainy season, and harvest began in the early part of December. The Costa Rican farmers planted somewhat later; their fields are not yielding. The variety planted in Nicaragua was a large white seed, while in Costa Rica a medium-sized red seed was preferred.

While the demand has fallen off noticeably since the signing of the armistice, it is probable that Central America will continue to grow castor beans for export. Planters seem to think that it would pay to grow castor beans if the price were from 4 to 5 cents f.o.b. port of departure. They have learned that a close stand of castor plants kills out weeds, leaving the land in excellent condition for planting coffee, beans, corn, or rice.

ON the recommendation of the Road Board the British Government has decided to make special grants to the amount of \$50,000,000 in aid of road construction work. Of this sum about \$9,000,000 will be provided out of the road improvement fund and the rest drawn from the National Exchequer. In making this decision the Government was influenced by a consideration of the fact that heavy extra expenses will fall upon highway authorities in the near future in connection with work on roads and bridges, as the result of higher prices, lack of materials, shortage of labor and difficulties of transport.

# Bombing Work of the British Independent Air Force

Specially Organized to Bomb German Industrial Centers—Made 142 Raids Between October, 1917, and June, 1918—Preparations for Long Distance Raids Complete When Armistice Was Signed

LONDON, Jan. 28.—If the war had continued through the summer and fall of 1919, the work of bombing aircraft squadrons on the western front would have been carried much further than it was. The extensive bombing program of the British, who took the lead in this work, was just getting into shape when the armistice came round, and the final chapters of the work will never be written.

The value of large planes for day and night bombing was not appreciated before the Handley-Page long-distance trip from London to Constantinople in July, 1917, when it made the trip to destroy a Turkish battleship, and succeeded. That trip carried conviction into the hearts of those controlling the Royal Air Force, and the reasoning was that if so much could be done with an experimental machine what might be accomplished with squadrons of perfected machines employed in day and night bombing over the manufacturing cities in the Rhine Valley.

## Planned to Bomb Berlin

A comprehensive bombing program was decided upon, and in October, 1917, a few squadrons of bombers were in the zone of Nancy, which was the nearest point to the Rhine Valley from which to launch an attack. From October, 1917, to June, 1918, 142 bombing raids were carried out, 57 of which were over Germany, the remainder being over portions of France held by the Huns. This work was so successful, in spite of bad fall and winter weather, that it was decided in May, 1918, to organize a separate air force to carry out this bombing work. Accordingly, there was formed in May, 1918, what is known as the Independent Air Force, which assumed complete charge of day and night bombing, and had within its organization special pursuit or single and two-seater fighting machines to escort the bombers and fight off the Hun chaser planes that attempted destruction of the bombers.

This great bombing plane campaign was just approaching its really aggressive stages in November, and had the armistice been delayed a month there would have been squadrons of huge bombers that were built to carry the program right to Berlin. Huge machines were being rushed to completion in many British factories and some of them had been tested out only a few days before Nov. 11. One of these was a huge Handley-Page biplane fitted with four Rolls-Royce engines, two on either side of the single fuselage, and spaced between the wings. The engines on each side are mounted in tandem and carry two propellers, one tractor and one pusher. This plane carried forty passengers in its test trip over London, and it had fuel capacity to reach Berlin and return to the aerodrome in Northeastern France.

Although the Independent Air Force was just in its swaddling garments when peace came, it had from June,

1918, to Nov. 11, 1918, established a record that gives indications of what might have been expected by the autumn of 1919.

From June 6 to Nov. 10 there were dropped 550 tons of bombs in day and night bombing, 160 tons by day and 390 tons by night. Of this, 220½ tons were dropped on enemy aerodromes, the aim being to destroy as many of the enemy machines as possible so they could not be used to attack the bombers. There was a heavy destruction of Hun planes by these attacks, yet in the same period not a single British bomber was destroyed by Hun attacks on British aerodromes.

In this dropping of 330 tons of bombs on German manufacturing centers in the Rhine valley and beyond, the general plan was to bomb a great many manufacturing centers rather than attempt to completely destroy one or two centers, in order to disperse the German system of defense requiring them to provide certain protection for all of their cities rather than furnishing complete protection for a few at a time and shifting the forces as the attack shifted.

In this way the British Independent Air Force bombed over forty cities including Cologne, Coblenz, Frankfurt, Heidelberg, Karlsruhe, Mainz, Mannheim, Luxemburg, Stuttgart, Worms, Wiesbaden and other places.

The first great essential in this work was extending the flying radius of the machines so that they could remain 5¼ hours in the air. Many machines when they reached the aerodrome back of the front had only 3¾ hours' fuel, and it was necessary to rebuild their fuel systems to give over 5 hours' capacity.

## Record Bombing In August

Many long-distance flight records were established, and from month to month during the summer of 1918 these distances were increased. The following tabulation shows how distances steadily increased from 272 in June, 1918, to 320 miles in October, 1918, in day flying. The range of night flying increased from 240 miles in June to 342 in August. Here are the figures:

	By day Distance out and back	By night Distance out and back
June .....	272 miles	240 miles
July .....	272 "	300 "
August .....	330 "	342 "
September .....	320 "	320 "
October .....	320 "	272 "

August was the best month for both day and night bombing, as in September and October the rains and fogs cut distances down.

The machines used in this bombing work were constantly being changed from its start in October, 1917.

up to November, 1918. The work started in 1917 with the following squadrons:

- One squadron DH4, 275-hp. Rolls Royce.
- One squadron FE2B, 160-hp. Beardmore.
- One squadron Handley Page, 375-hp. Rolls Royce.

In spite of the very severe winter of 1917-1918, this force carried out its 142 raids between October and May, and bombed such cities as Mannheim, Mainz, Coblenz, Cologne and Stuttgart. Long-distance raids were made on Namur and Liege in Belgium.

In the summer of 1918 the force was increased by the following squadrons:

- May 23—One squadron, DH9, B. H. P. engine
- Aug. 9—One squadron, Handley-Page, Rolls Royce engine
- Aug. 19—One squadron, Handley-Page, Rolls Royce engine
- Aug. 31—One squadron, DH10, Liberty engine
- Sept. 22—One squadron, Sopwith Camel

#### Escorts for Bombing Squadrons

A squadron was not pushed in bombing work the day it arrived at the aerodrome, but was given three weeks of final training, which it was only possible to carry out at the front.

The general scheme of bombing was that the bombing planes should proceed straight from the aerodrome to their objective, not deviating for any reason. To make this possible the squadron of Sopwith Camels was a fighting escort. These chasse machines had a normal fuel range of slightly over 2 hours, and they had to be rebuilt with fuel capacity for 5½ hours. It would have been suicidal to send the laden bombers without the protecting scouts, which scouts had to be prepared to accompany them the entire distance. This was particularly true of day bombing.

At the start the enemy was not prepared to adequately resist the British bombing program, and it was not until June, 1918, that the Hun planes were coming out in heavy squadrons to resist the British. In August it was necessary at times for bombing squadrons to fight every mile of the way from the aerodrome to the objective and back home. It was necessary to maintain formation accurately, as the Boche could cut off at his leisure every machine that had to drop behind its formation. They invariably concentrated their attacks on the rear machines, and if even a spark plug failed, necessitating a lag behind the formation, it meant a victim for the Boche. In all, 100 British planes were lost, the pilots either being shot down or the plane having to land out of control.

#### Railroads Vital Points

In this bombing work the British concentrated on railroad lines, stations and storehouses. After these came blast furnaces. The Boche was short of rolling stock, and destroying his railroads made the moving of food and munitions more difficult. Railroad lines are good targets at night, as are blast furnaces. The amount of destruction in blast furnaces was small per bomb that found its target, but they were good targets.

A complete intelligence department was organized to gather information and prepare maps for the work. In this way the most thorough information on all targets, such as gas factories, airplane factories, engine factories, poison-gas factories and railroads, was supplied with detail maps of each target, this work being done by day and night reconnaissance machines.

Long-distance bombing work requires the utmost determination, as a change of wind completely upsets all

calculations that may have been made before starting. It requires fine judgment on the leader's part to know, if he perseveres to the objective, whether he will have sufficient fuel to carry the formation home again safely. This will be realized when it is pointed out that on several occasions the machines with only 5¼ hours' fuel supply were out for that time; in one case a formation was out for 5 hours and 30 minutes, and it only just managed to clear the front-line trenches on its homeward journey. A miscalculation of five minutes would have lost the whole formation.

Ceiling was of more importance than speed for long-distance day bombing work. It was essential that squadrons should fly as high as possible, and it soon became apparent, as already stated, that the two squadrons with the 200-hp. B. H. P. engines had not sufficient power for this long-distance work. One squadron was re-equipped with D. H. 9a machines with Liberty engines in November, before the signing of the armistice, and the second squadron had started re-equipping.

Major General H. M. Trenchard, who commanded the Independent Air Force of the R. A. F. in his detailed report on the bombing work has given many incidents which show the risks taken and the difficulties to be overcome. No more efficient general could have been selected for this work, and from the start he took hold and started building up the force along a definite plan rather than changing the schemes from week to week as conditions seemed to indicate. In his report he outlined his general policy as follows:

"It was necessary for the B. E. F., (British Expeditionary Force) to have enough aircraft to hold and beat the German aerial forces on the western front. Bombing of Germany would be a luxury until this were done, and once this were done then bombing became a necessity. That is to say, it became necessary to strike the German army in Germany and to strike at the most vital point—its source of supply.

"In using the Independent Air Force for this purpose I was faced with two alternate schemes of campaign:

"1—To attack as many of the large industrial centers as possible to reach with my machines.

"2—A sustained and continuous attack on one large center after another until each was destroyed, the industrial population having to go to other cities.

"The first plan was decided upon.

"The weather in June, July and August was extremely favorable for long-distance bombing, but in September, October, and the first week of November, it could hardly have been worse. Day after day attempts were made to reach the long-distance targets, but the wind was generally too strong. If there was no wind there was heavy rain and fog by day and dense mists by night. Frequently the nights were perfect, but dense mists covered the ground and made landing impossible and also hid the targets.

"I also recommended that the proportion of day bombing squadrons in the force should be slightly larger than that of night bombing squadrons, as I considered that, although day bombing squadrons suffer higher casualties than night bombing squadrons, at the same time, if day bombing is excluded, at least four-fifths of the value of night bombing must necessarily be wasted, owing to the fact that the enemy can then make his arrangements to work by day and live at a distance by night, and take many other similar defensive steps. Also, if the bombing had been carried out exclusively by night it would not have caused the enemy to make such a large use of his men and material in defensive measures, and therefore it would not have affected the western front to such an extent as it did. Though night bombing is

the safer, many mistakes are made at night in reaching the locality it has been decided to bomb.

Those portions of General Trenchard's report dealing with individual attacks read like chapters from fairy tales. Mannheim, the great manufacturing city where Benz cars and planes are made, was the objective of many attacks.

One formation of bombers was attacked by forty Hun fighting scouts when over the city. Two of these were shot down and three others went down out of control. It required 5 hours and 30 minutes for this trip, but so short of fuel were the fliers that they just got over the trenches on the home trip, and did not reach the aerodrome, the fight over Mannheim consuming quite some time.

### Mannheim Attacked Frequently

In another Mannheim raid, in August, twelve DH4 bombers were attacked just as they reached Mannheim by fifteen Boche fighting planes. The British formation dropped to within 6000 ft. of the city and dropped all their bombs. The formation leader was shot down, and in the melee three Hun planes were shot down. Ten planes in the formation dropped their complete loads, and seven bursts on a factory were observed and four fires started. A direct hit was also made on a new factory building. Two of the formation had to land before they recrossed the German lines.

Another night two Handley-Page bombers attacked the Balische Anilin & Soda Fabrik in Mannheim and indulged in a spectacular attack, typical of night bombing. The Handley-Pages left their aerodrome at eight o'clock, and when 5000 ft. over the target one pilot shut off his engine and glided down on the factory. The searchlights at once picked him up and held him in their beams while the anti-aircraft barrage was put up. The machine continually changed its course, but could not shake off the searchlights, and the pilot was completely blinded by the glare. At this moment the second machine glided in, with its engine almost stopped, underneath the first machine, got immediately over the works, below the tops of the factory chimneys, and released its bombs right into the works. The searchlights at once turned on to this machine, freeing the first machine from their glare. This machine then turned and made straight for the works as low as the second machine, among the chimneys, and released its bombs. The searchlights were turned almost horizontally to the ground and the anti-aircraft guns were firing right across the works and factories almost horizontally. In spite of this the two machines remained at a low altitude, and swept the factories, works, guns and searchlights with machine-gun fire. On the return journey both of these machines passed through rain and thick clouds, while lightning and thunder were prevalent throughout the trip.

### Direct Hits on Factories

On Sept. 7 eleven machines of one squadron, followed by ten machines of another, made an almost simultaneous attack on Mannheim, where bombs were dropped with excellent results on the Badische Anilin and Soda Fabrik. The first squadron obtained at least eight directs on the factory, but the results of the second squadron could not be observed owing to the mist and smoke. Both squadrons were attacked on the outward and return journey, and over the objective, by superior numbers of hostile aircraft.

One squadron was attacked by six hostile machines 15 miles over the lines. These were driven off. Ten hostile machines attacked about 15 miles over the lines. They were also driven off. Fifteen hostile machines then at-

tacked over the objective. After dropping bombs the formation turned toward the hostile machines, which apparently disconcerted them, as they became scattered. On the return journey several enemy scouts kept up a running fight. One scout, attacking from in front, was driven off by the leader's observer firing over the top plane.

The other squadron was attacked at a long range 15 miles over the lines. The enemy were driven off. Fifteen hostile machines heavily attacked over the objective and followed the formation back for 70 miles. Near the lines the formation was again attacked by seven hostile machines. Over two tons of bombs were dropped at Mannheim in this raid.

On the night of Sept. 16-17 seven Handley-Page machines were missing. Five of these, detailed for Cologne and Mannheim, were probably unable to return in the face of a strong southwesterly wind, which increased after the machines had left the ground. The missing machines undoubtedly attacked various objectives well into Germany before they had to land. It was reported that one machine landed in Holland with engine trouble after having dropped its bombs on Bonn, and was interned.

### Enemy Attacks Frequent

On Sept. 25 Squadron A dropped over 1½ tons of bombs on Frankfurt. They were opposed by a large number of hostile machines, two of which they destroyed. Four of our machines did not return, and in addition one observer was killed and one observer and one pilot were wounded. This was the first long-distance raid carried out by this squadron.

On the night of Oct. 21-22, machines attacked the railways at Kaiserslautern in very bad weather. Several 1650-lb. bombs were dropped, but bad visibility obscured the results. One very large fire and five smaller ones were observed, and all these fires were seen to be still burning when the town was lost sight of in the mist.

A few other examples will serve to visualize the character of this bombing work. On the night of June 29-30, Handley-Page machines were ordered to attack the chemical works at Mannheim. Owing to the weather conditions, only one machine reached the objective, on which it dropped its bombs. This machine, on the homeward journey, failed to pick up its aerodrome, and landed no less than 160 miles southwest of the aerodrome undamaged.

On July 5, 12 machines set out to attack the railway sidings at Coblenz. Shortly after starting the squadron passed over thick clouds and steered its course by compass, but the target was obscured by clouds. The leader turned, with the intention of attacking Karthaus, but as he turned the anti-aircraft barrage over Coblenz opened. Through a small hole in the clouds he could see a portion of the target, and the formation followed him and released their bombs.

On July 31, planes went out to attack Mainz. They encountered 40 hostile scouts south of Saarbrücken. Fierce fighting ensued, as a result of which four of our machines were shot down. The remaining five machines of the formation reached Saarbrücken and dropped their bombs on the station. On their way home they were again attacked by large numbers of hostile scouts, and suffered the loss of three more of their number.

On Aug. 11 a squadron attacked the station at Karlsruhe, in spite of bad weather conditions, causing a heavy explosion in the station and scoring many direct hits on the railway sidings. In the course of fighting one of our machines was brought down and three of the enemy's machines were driven down out of control.



# The F O R V M



## An Analysis of the Hotchkiss Drive

By A. W. Happel

THE writer was very much interested in the article "Analysis of the Hotchkiss Drive" by O. M. Burkhardt, appearing in your Jan. 23 issue. Upon looking it over carefully I encountered some statements which I shall presently disprove.

Let us start with the spring loads as given for the 20,000 lb. spring supported Hotchkiss chassis when driving on low gear.

Mr. Burkhardt calculates that we have spring loads as follows:

On front springs .....	4,250 lb.
2 rear springs, front eyes at 6458 .....	12,916 lb.
2 rear springs, rear eyes at 3938 .....	7,867 lb.
Total .....	25,042 lb.

Now our chassis weighs only 20,000 lb. above springs and will, accordingly, due to the spring upward reaction, develop, considerable, aeronautic tendencies, if Mr. Burkhardt's figures are correct. It will be interesting, therefore, to go over this case again, using the same notations and load distribution as in the above-mentioned article.

We soon discover that the statement " $W_r = 15,750$  lb., Fig. 2," is obviously wrong, since  $P'$  applied in the upward direction and between the front and rear wheels must reduce the load on both the front and rear springs. Mr. Burkhardt's error is made in assuming  $P'$  as acting on the rear spring, while it actually finds its reaction between wheel and ground.

We, therefore, derive the correct value for  $W_r$  from the formula.

$$W_r = W - P_r' = 15,000 - 1770 = 13,230 \text{ lb.}$$

In going over to the Hotchkiss chassis, Fig. 3, it is wrong to assume that the loads remain the same as in the previous case, in spite of shifting the point of torque reaction.

We actually have the following loads for this case:

$$P_f' = \frac{P' \times 25}{168} = \frac{5040 \times 25}{168} = 750 \text{ lb.}$$

$$P_r' = \frac{P' \times 143}{168} = \frac{5040 \times 143}{168} = 4290 \text{ lb.}$$

$$W_r = W - P_r' = 15,000 - 4290$$

$$W_r = 10,710 \text{ lb.}$$

$$W_f = W_f - P_f' = 4250 \text{ lb.}$$

Proof:

(a) Forces in upward direction:

$$\text{Spring reaction } W_r = 10,710 \text{ lb.}$$

$$\text{Spring reaction } W_f = 4250 \text{ lb.}$$

$$\text{Torque reaction } P' = 5040 \text{ lb.}$$

$$20,000 \text{ lb.}$$

(b) Forces in downward direction:

$$W = 20,000 \text{ lb.}$$

We see everything is nicely balanced.

To determine the actual loads on the rear spring eyes, it is best to remember that the rear axle also must be in equilibrium; i. e., we must have:

$$\Sigma M = 0$$

We have a clockwise moment of

$$T \times 20 = 126,000 \text{ lb.-in.}$$

A counter-clockwise moment of

$$P' \times 25 = 126,000 \text{ lb.-in.}$$

Any additional moments, due to frame load, must, therefore,

of necessity be balanced, if a symmetric spring is used, i. e., each spring eye will receive:

$$\frac{10,710}{4} = 2677.5 \text{ lb.}$$

We then have for the load on the rear spring front eye:

$$\frac{5040}{2} + 2677.5 = 5197.5 \text{ lb.}$$

and for the load on the rear spring rear eye we get 2677.5 lb.

The summation of vertical forces will, therefore, be:

Upward: Reaction of front springs..... 4250 lb.

Reaction of 2 rear springs, front eyes at 5197.5 10,395 lb.

Reaction of 2 rear spring rear eyes at 2677.5.. 5355 lb.

Upward total ..... 20,000 lb.

Downward:  $W = 20,000$ .

Going over to the brakes we hear that in the case of the chassis shown in Fig. 2 the rear springs are loaded less than ordinarily when the brakes are applied. Analyzing this claim we find that, using Mr. Burkhardt's figures, we have a torque reaction of:

$$P' = \frac{180,000}{50} = 3600 \text{ lb., downward.}$$

Of course, the springs have to carry this additional load. Reaction  $P'$  cannot act on the spring for even if—

$$P' > W_r$$

it will only lift the rear end of the chassis off the ground but cannot increase our spring load.

$$P_r' = \frac{3600 \times 118}{168} = 2530 \text{ lb.}$$

$$W_r = 15,000 + 2530 = 17,530 \text{ lb.}$$

i. e., considerably more than when driving on low gear.

The maximum spring eye load, then, for this chassis is

$$\frac{17,530}{4} = 4382.5$$

Front axle load

$$W_f = 5000 + \frac{3600 \times 50}{168} = 6070 \text{ lb.}$$

A summation of the forces for this case is then as follows:

Upward:

Reaction of front springs ..... 6070

Reaction of rear springs ..... 17,530

Total ..... 23,600

Downward:

$$W = 20,000 \quad P' = \frac{23,600}{3600}$$

Turning now to the analogous Hotchkiss chassis, Mr. Burkhardt's figures again prove erroneous if the actual moments of forces are analyzed. Referring to the accompanying figure, we find:

$$P' = \frac{180,000}{25} = 7200 \text{ lb.}$$

$$P_r' = \frac{P' \times 193}{168} = 8270 \text{ lb.}$$

$$W_r = W - P_r' = 15,000 - 8270 = 6730 \text{ lb.}$$

Or, per spring eye,

$$\frac{6730}{4} = 1682.5 \text{ lb.}$$

Then, as before, load on rear spring front eye: 1682.5.  
Load on rear spring, rear eye,

$$1682.5 + \frac{7200}{2} = 5282.5 \text{ lb.}$$

Load on front axle,

$$W_f = 5000 + \frac{7200 \times 25}{168} = 6070 \text{ lb.}$$

Summation of vertical forces for this case:

Upward: Front spring reaction ..... 6,070 lb.  
Reaction of 2 rear spring front eyes .... 10,565 lb.  
Reaction of 2 rear spring rear eyes ..... 3,365 lb.  
Total upward forces ..... 20,000 lb.

Downward:

$$W = 20,000.$$

We see, therefore, that there is not so great a difference in the spring loads of the two types of chassis as Mr. Burkhardt imagines, for, using his own figures, we find a deflection:

$$d_1 = 4 \times \frac{1650}{4382.5} = 1.50$$

and

$$d_2 = 4 \times \frac{1650}{5282} = 1.250$$

The above calculations do not consider moments due to location of axle relative to spring top leaf, etc., although these must be considered in a full analysis of the case as Mr. Burkhardt states.

It appears, therefore, that we have in the Hotchkiss drive

not only a much simpler, less expensive and very much lighter mechanism, but also one which will show no difference in riding qualities, for we have only to increase our spring travel from 4 in. to

$$\frac{4 \times 1.50}{1.25} = 4.80 \text{ in.}$$

to be able to use the same spring rate, pounds per inch, as in the torque rod chassis.

There need not be any fear of faulty action of the brakes if they are correctly designed, and there is no excuse for not designing them so. In fact, we have the great advantage of cushioning a sudden application of the brakes or driving torque.

Spring loads can be reduced by increasing the length of the springs. The earmarks of a good Hotchkiss chassis are, therefore, adequate spring travel and long springs. A still further reduction on spring loads can be made by the use of under-slung springs—a favorite design on passenger cars.

The torque rod, on the other hand, when brakes are applied, imparts to the frame an important additional load; in our case almost two tons (3600 lb.). This is equivalent to a sudden overload of 36 per cent. It is evident, therefore, that it is much more dangerous to overload a torque rod chassis than a Hotchkiss drive chassis.

In passing it might be interesting to have the views of the advocates of torque rods on the bearing loads on the rear end of the torque rod which are extremely high and not easily taken care of.

In conclusion, I agree with Mr. Burkhardt that there is no need of hypotheses in spring design but all loads can be accurately determined by mathematical deductions.

## Government Operation of Tractors Successful

GREAT BRITAIN has inaugurated a plan for Government operation of farm tractors in Yorkshire, England, whereby the machines work in units at fixed charges. Five units are operated, each comprising 10 tractors, 10 2 or 3 bottom plows, 4 cultivators, 3 or 4 binders, 2 rollers, etc. The tractors used are of two types, of 20 hp. each. Minimum charges have been established, according to the report, by the West Riding War Agricultural Committee as follows:

Plowing—Light land (3-horse work), \$5.48 per acre; medium land (2-horse work), \$6.69; heavy land (3-horse work), \$7.91; heavy land (4-horse work), \$9.13.

Cultivating—Disk or drag harrowing, \$2.74 to \$3.65 per acre; breaking stubble after harvest with cultivator, \$3.16 to \$4.87 per acre; rolling if 2 rollers are drawn, 85 cents per acre.

Harvesting—Reaping, with self-binder, field 10 acres and over, \$3.65 per acre; 5 to 10 acres, \$3.89 per acre; under 5 acres, \$4.26 per acre; haulage of farmer's binder, \$1.46.

"These charges," states the U. S. Consul transmitting the report, "in general work out at substantially below the cost of team labor on the land. While it is true that the British Government in 1917 undertook plowing operations at a minimum of \$3.65 an acre, it is now known that this price involved a considerable loss. Even at a minimum charge of \$5.48 per acre for plowing, the demand for tractors is greater than ever.

"Perhaps the best testimony to the usefulness of the tractor has been the part it has played in the reclamation of derelict land, of which class there has been a large proportion in the country and which the North Riding War Agricultural Committee has set to work to bring under cultivation. These lands have been widely scattered, and in two districts in particular the task was very difficult. With the aid of the tractor, however, tree roots have been stubbed up, whins cleared, gaps filled, bushes removed, and the land generally prepared. This was all done with the aid of the tractor, and many acres of useful arable land was obtained which was put into wheat.

"Some interesting information furnished by the committee illustrates the part which the tractor has played in increas-

ing the area under cultivation in North Riding. In 1917 motor tractors were used for plowing and cultivating to a limited extent, and were regarded by the farmers as more or less of an experiment. During 1918 the committee had 103 tractors at work, an increase of nearly 70 per cent on those employed the previous year."

## Decrease in Iron Ore Production

THE estimated quantity of iron ore mined in the United States in 1918 amounted to 69,712,000 gross tons, compared with 75,288,851 tons in 1917, a decrease of 7.4 per cent. The estimated shipments of ore from the mines in 1918 were 72,192,000 gross tons, valued at \$246,043,000, compared with 75,573,207 tons, valued at \$238,260,444 in 1917, a decrease in quantity of 4.5 per cent but an increase in value of 3.3 per cent. The average selling value of the ore per gross ton at the mines for the whole United States in 1918 was \$3.41, compared with \$3.15 in 1917. The stocks of iron ore at the mines apparently decreased from 10,628,908 gross tons in 1917 to 8,139,000 tons in 1918, or 23.5 per cent.

The decrease in output, which was general throughout the country, is probably to be attributed to a combination of circumstances. Industrial conditions were more or less disturbed, the supply of labor was uncertain, and transportation facilities were inadequate, but notwithstanding these handicaps the shipments from the Lake Superior district from April to October, inclusive, 1918, were over 2,500,000 tons more than those for the corresponding period of 1917. Owing to a scaling down of furnace requirements, however, in order to release vessels for carrying grain to Europe, the shipments in November and December, 1918, were nearly 4,000,000 tons less than those made in November and December, 1917. Government control of the entire steel supply, which became effective in June, 1918, undoubtedly regulated the demand for ore, and stocks at mines and lower Lake ports were somewhat reduced, so that the consumption of ore remained about the same as in 1917.

# Radical Element Is Destroying Labor Organizations

Organizations Are Too Ready to Disregard Instructions or Counsel of Their Elected Leaders

By Harry Tipper

**A**TENTION has been drawn in these articles to the tendency in labor organizations to withhold power from the leaders, or to disregard the instructions of the duly elected executives when such instructions appeared to be contrary to the immediate and local necessity of the branch of the organization involved. Not only is this the case, but there is an ever present tendency for the labor organization in any locality or occupation to follow the radicals, the men who are in favor of direct action.

There are many reasons for this tendency. The labor organization has been based in its traditions upon the promise of advantage to be secured by getting together for the purpose of bargaining with the employer or owner. The labor leader, who has had the responsibility of directing the action of labor in the many intricate and complicated problems with which it has to deal, seeing the danger in many of the proposals, becomes conservative and careful in his attitude. The irresponsible radical is in an excellent position to agitate against the apparent inactivity, or actual obstructionist policy of the leaders as he sees them, and promise all sorts of advantages for adopting the policies he outlines.

This leads to the sharp division which is to be observed in all labor organizations and the statements of labor leaders that we are living above a powder magazine. To the average workman the advantages of belonging to a labor organization are compassed by the actual improvements in hours and wages which are constantly insisted upon.

So soon as these advantages cease to accrue from the organization, no matter how much of value they may have accomplished in past history, the rank and file become dissatisfied and critical, and are likely to question the merit of the payment of the necessary dues. They are likely to insist upon action, and to bring sufficient pressure to bear upon the leaders to force them to some action, whether they believe it is wise or not; or they may decide to act without the regular method of decision through the appointed officers and executive committee.

## Danger of Organized Labor Inside the Organization

It is in this constant anarchistic tendency within the labor organization itself that the grave danger of the organized labor movement lies. Were it possible to secure an agreement with labor by conferences with its leaders with which the general body concurred it might be possible to settle some of the problems that confront us. This might be accomplished through agreements between committees appointed by the manufacturers' groups and committees appointed by the labor organizations. This is so far from being the case, however, that it is somewhat absurd to discuss the contingency, except that there exists a general tendency to accept the labor organizations at their face value and suppose that the

leaders can obligate the unions as congress can obligate the United States.

The indications of this have been visible for ten years previous to the great war, but that time of stress and emergency brought out the conditions very fully. It is significant that most of the strikes called during the war were called against the demand of the national leaders and such strikes were vigorously denounced by them.

## Strikers Taking Advantage of Uncertainty of Time

At this time there is a tendency to call strikes for no other purpose than to seize upon the present uncertainty and fluidity of public opinion to gain various classes of workers without regard to the general effect upon the whole economic structure. There is a definite propaganda going out from labor circles aimed at the probable change in commodity and wage values, but in reality to forestall any action which might result in the lessening of the political power of labor, which has grown so tremendously during the war.

These facts do not keep the manufacturer from observing and taking careful count of the public desire for a different organization of industrial establishments, nor do they justify the sweeping assertion that all labor demands are without justice and should not be encouraged. They really emphasize the necessity for just action and a studious consideration of the whole problem, so that the decision may not be prejudiced by the apparent absurdity of the demands made by some labor organizations, nor stamped by the propaganda which is issued freely by the radicals on both sides with the definite purpose of using the situation for political and individual advantage without any regard to the fundamental requirements of the case.

## Satisfied Workers Want No Interference

The present situation makes clear the impossibility of securing any peaceful and harmonious arrangement between capital and labor in the mass by general agreement between the leaders, and lends force to the argument that it is necessary for the employer to solve the problem for his own establishment and his own employees. This makes it important to examine the records of those establishments which have approached and dealt with this problem by organization changes, and which have placed some of the responsibility upon the workers and instituted some form of profit sharing plan in connection therewith. Particularly is it important that the records be looked up in the endeavor to discover what has happened in those establishments during the turmoil of the past few years and present difficulties. Fortunately it is possible to find this out in connection with some cases where the plans have been worked out for a sufficient length of time to permit of a valuable comparison.

Take the case of a plant in which the method of participation was through a house of workers' representatives,

a senate body of department heads and a cabinet of the general executives. This plant has been referred to in a previous article. During the war there was a general strike in this industry, and after the labor body and employers had failed to reach an agreement the War Labor Board of the government was called in to work it out. All this time this particular plant was working full time with no absences of employees. When the Labor Board was called in the workers in this plant addressed three special communications to Washington requesting that the decisions of the board be considered not to apply to that organization, as the workers there had no intention of striking and were so well satisfied with the plan under which they were working that they did not want it upset by any decision arrived at by the adjustment board. They were not satisfied that the government had wakened to the full significance of the case. In order to further safeguard their own interests they sent a deputation to Washington to wait upon the Labor Board and make sure that they would be left alone to continue as they were.

This is only one instance of the value of a plan whereby the employers and employees get together in the individual organization and work out the necessary plans with respect to that unit, but it is very significant. The conditions were favorable to the worker. The strikers were likely to profit by the wage board's decision, and the stern necessities of the war made the bargaining power of the workers almost unassailable. There was no special attempt made in the organization we are speaking of to give their workers any special advantages or advances in wages. The regular procedure was governing this case. Every inducement which could have acted upon the workers to join the general body in this industry was involved, and only the firm belief in the merits of the plan to which they had subscribed held them to their places. The value of the plan to the owners of that concern cannot be overestimated in this one instance.

#### Trouble Makers Unwelcome

In another case, the men in one department of the factory asked for an increase of wages through their representative. The board of representatives considered the case and turned the request down with its reasons. After a week or two the matter was brought up again by the same workmen and the reply was that conditions had not changed and the representatives did not feel that they were able to change their previous decision. The matter was brought up a third time and the same answer was given. Then the men went out on strike, and the representatives of the rest of the workmen said, "All right, if you feel that way about it, maybe you had better get out." In two weeks they were all asking for their jobs again. The rest of the plant had gone on, and other men had been secured for the department, because the rest of the workers said, "These fellows are trouble makers. We don't want them back in this establishment."

Here again is an illustration of the worker backing the organization which has convinced him that it is dealing with him squarely, with the books open, and giving him some share in the control of his own conditions. Instances of this sort can be taken from all organizations where this problem has been dealt with from the proper standpoint—that of getting the industrial unit, the individual organization, together on the common basis of sharing the benefits and difficulties, and sharing also in the responsibility for the conditions in which they work. They should make the manufacturer pause a little before casting out plans for industrial organization which may

seem to throw away his control, but which in reality give him more control than ever, because it is the solid control of an institution thoroughly organized upon a harmonious basis, where there is a team spirit which makes efficiency possible, and without which it is impossible to get any real efficiency.

#### A Question of Psychology

Some day the engineer and production manager and the other governing executives will know enough about the motives which govern human action to realize that efficiency is not a matter of machinery, nor is it a matter of the number of motions which must be made to complete a certain job. It is a matter of the relation of the complex mental and physical necessities to the work which it has to perform, and the social surroundings in which it must live and work. It involves a much greater degree of scientific research and development than all the mechanical arts which contribute their share to the necessities of manufacturing. It is not to be secured by the dogmatic attitude of mind which builds upon its own prejudices an unassailable logic, unassailable because there is no possibility of argument with prejudice. It cannot be secured by assuming that any particular form of organization is the correct one for these conditions merely because it was correct forty years ago.

After all, the necessity which is constantly before the manufacturer is production at greater value for less expense, more efficient work for less expenditure of man power. This means an intelligent study of the things which affect the mental and physical capacity of the man, the effect of tradition, the application of the deep seated human desires and the effect of the character of his surroundings upon his work. There are enough experiments in organization to give their practical value from a production standpoint, and they are necessary if we are to have industrial peace.

#### Book Review

*Cost Accounting*, by J. Lee Nicholson and John F. De Rohiba. Published by the Ronald Press Co., New York. Five hundred and seventy-six pages, 5½ x 8 in. Price, \$6.

This is a comprehensive volume on the subject indicated by the title, by members of a firm of supervising cost accountants. The importance of cost accounting in factory operation has been brought home to a great many manufacturers in recent years who gave it little consideration previous to that time. Much effective educational work along this line has been done by the Federal Trade Commission, with a view to establishing more stable conditions in industries. Another thing that has helped to bring the subject of cost accounting prominently to the fore is the fact that a movement has been launched in various industries to standardize cost accounting methods for the particular industry.

The present volume is an extension of a previous book on the same subject by the senior author, "Cost Accounting; Theory and Practice," which was published in 1913. It has been the author's aim to classify the details of cost accounting so that the reader may get a well defined idea of the forms and records required for each separate operation, and how these forms and records fit into the general system used in any particular establishment. Every feature of cost accounting is gone into in the book and numerous forms are illustrated.

#### Christensen Starter on Duesenberg Engine

IN the description of the Duesenberg 800-hp. engine which appeared in the Jan. 23 issue of *AUTOMOTIVE INDUSTRIES* there was shown a front view of the engine which illustrated very clearly the mounting of the starter with which the engine was started while on the test stand. This is the Christensen starter, aero type.

# Small Inlet Valves Satisfactory in Overhead Valve Design

British Engineer's Tests Prove High Charging Capacity—Specific Fuel Consumption Largely Independent of R. P. M. and Torque for 50 to 60% of Maximum Horsepower

Fitting Electric Starting and Lighting Units Easiest on Valve-in-Head Designs

## PART I

LONDON, Jan. 15—L. H. Pomeroy, engineer of Vauxhall Motors, Ltd., recently read a paper before the Institution of Automobile Engineers here in which he analyzed a series of tests made with two engines of approximately the same size, about 3 liters (90 by 120 mm.). One was a valve-in-head design and the other an L-head with valves side by side in the valve pocket.

The paper was of unusual interest due to several facts that are deeply concerning the British automobile engineer at present. The entire European industry is landsliding to electric starting and lighting, and fitting the starting motor and electric generator on an L or T-head engine is almost impossible, according to Mr. Pomeroy, whereas it is relatively easy on a valve-in-head design.

Valve-in-head engines were not taken up in England because of the noise and the national demand for silence. Now that quiet over-head-valve designs are possible and practical the British engineer, and the French and Italian engineer as well, is taking a new interest in this design, and Mr. Pomeroy's paper took on a new international importance because of this. Italian and French engineers have openly expressed their sympathy for the overhead valve, and the next two years will record many new European designs with this valve scheme.

### Test for Average Conditions

Mr. Pomeroy faced the problem in one of the most practical ways possible and carried out his tests to meet the average touring car conditions, rather than racing car or aviation engine conditions.

He used three different diameters of inlet valves on the L-head and valve-in-head engines and proved to his own satisfaction that with the valve-in-head design you can use very small-diameter valves, with high inlet gas velocity and get good horsepower and high fuel efficiency. He satisfied himself that increase in brake horsepower is not proportional to increase in inlet valve area, and that maximum brake-horsepower is largely independent of inlet gas velocity. In his opinion very much higher gas velocities can be used than are common in present-day practice.

The European designer must always keep in mind the fuel economy of his car, and here, too, Mr. Pomeroy has arrived at some interesting conclusions. Fuel consumption is not related directly to inlet gas velocity; in other words, the diameter of the valve does not materially affect the fuel consumption per horsepower hour.

Three different areas of inlet valves were used, 1.8 sq. in., 1.4 sq. in., and 0.7 sq. in. The carburetor setting in each test was not necessarily that for maximum economy, but rather to give easy starting and good road acceleration; in

fact the carburetors were tuned up from the point of view of the average driver.

The two engines were practically identical in design except for valve arrangements. In both engines the compression pressures at full throttle were nearly equal in each of the corresponding tests, thus demonstrating that there is no appreciable difference in the charging effect with different valve diameters when the valve lift is kept constant.

Mr. Pomeroy discussed his experimental data under the eight following heads:

- 1—Inlet gas velocity and maximum brake horsepower.
- 2—Inlet gas velocity and brake mean effective pressure.
- 3—Inlet gas velocity and fuel consumption at full load.
- 4—Inlet gas velocity and fuel consumption at varying loads.
- 5—Revolution speed and brake mean effective pressure.
- 6—Revolution speed and fuel consumption at full load.
- 7—Revolution speed and fuel consumption at varying loads.
- 8—Fuel consumption per hour for any given brake horsepower, irrespective of engine speed.

The particulars of the two engines tested are as follows:

	Engine A	Engine B
Bore	90 mm.	90 mm.
Stroke	120 mm.	115 mm.
Compression ratio	4.8:1	4.8:1
Inlet valve dia.	1.75 in.	1. $\frac{3}{4}$ in.—1. $\frac{3}{8}$ in.—1 in.
Inlet valve area	1.8 sq. in.	1.8 sq. in.
	1.4 sq. in.	1.4 sq. in.
	0.7 sq. in.	0.7 sq. in.
Exhaust valve dia.	1.75 in.	1.5 in.
Exhaust valve area	1.8 sq. in.	1.75 sq. in.
	1.4 sq. in.	
	0.7 sq. in.	

Valve Timing	Engine A	Engine B
Inlet valve opens	10 degrees late	0 degrees
Inlet valve closes	47 degrees late	44 degrees late
Exhaust valve opens	65 degrees early	40 degrees early
Exhaust valve closes	17 degrees late	0 degrees

**Deduction.**—Increase in brake horsepower is not proportional to the increase in valve area; in other words, the small inlet valve is more useful per unit of area than the larger one. The maximum brake horsepower in the normal touring car engine is very largely independent of gas velocity through the inlet valve, and much higher velocities can be used than are common in practice at present.

Mr. Pomeroy in arriving at this deduction analyzed his experimental data as follows:

Tables I and II and Figs. 1 and 2 show the tabular and plotted values of inlet gas velocity and brake horsepower for both engines. The brake horsepower were measured by a Froude dynamometer. The curves indicate that the brake horsepower is still rising in each engine with the 1.8 and 1.4 sq. in. area valves at the maximum revolution speed of the experiments. From other tests, however, it is known that the maximum brake horsepower shown is very nearly indeed the maximum attained, and can be regarded as such. It will be seen that in engine A the increase in valve area from 1.4 sq. in. to 1.8 sq. in. corresponds with an increase in maximum brake horsepower of 4, i. e., from 42 to 46, some 9 per cent. The results in Table I (valve area 0.7 sq. in.) relating to engine A indicate a very poor power performance, and are not offered for criticism.

Expressing maximum brake horsepower in terms of valve area for engine A we have:

1.8 sq. in. valve..... 6.3 hp. per sq. in. of valve area  
1.4 sq. in. valve..... 7.6 hp. per sq. in. of valve area  
0.7 sq. in. valve..... 9.8 hp. per sq. in. of valve area

In each case the maximum brake horsepower is attained at

TABLE I  
ENGINE A—FULL LOAD TESTS  
INLET VALVE AREA, 1.8 SQ. IN.

Revs. per Minute	B.H.P.	Compression, Lb. per Sq. In.	$\eta_p$ , Lb. per Sq. In.	M.E.P.* Calculated, Lb. per Sq. In.	Gas Vel., Ft. per Sec.	Fuel, Pints per B.H.P. per Hour
2,400	45.5	105	80.5	94.5	167	0.75
2,200	42.2	105	81.5	94.5	153	0.72
2,000	39	102	82.7	94.7	139	0.75
1,800	35.4	100	83.5	94.5	126	0.78
1,600	31.6	99	84	94	112	0.82
1,400	27.5	96	83.4	94.5	98	0.87
1,200	23.5	94	83.2	91.2	84	0.92
1,000	19.3	93	82	85	70	0.98
800	14.7	91	78	85	56	1.05

INLET VALVE AREA, 1.4 SQ. IN.

2,400	42.9	104	76	90	220	0.71
2,200	40.4	104	78	90	202	0.72
2,000	38.7	101	80	92	183	0.73
1,800	34.7	100	81.9	92.9	165	0.74
1,600	31.25	98	82.9	92.9	147	0.76
1,400	27.5	96	83.4	91.3	128	0.78
1,200	23.55	94	83.3	91.3	110	0.83
1,000	19.3	92	82.0	88	92	0.88
800	15.30	90	81	83	73	0.94

\*Calculated M.E.P. excludes fluid and pumping losses.

INLET VALVE AREA, 0.7 SQ. IN.

2,400	27.5	85	45.1	450	1.01
2,200	27.6	85	53.25	412	0.92
2,000	27.5	91	58.5	374	0.87
1,800	26.5	95	62.5	337	0.84
1,600	25	98	66	300	0.83
1,400	23	98	70	262	0.85
1,200	20.5	96	73	225	0.89
1,000	17.3	95	73.5	187	0.95
800	13.7	95	72.8	150	1.04

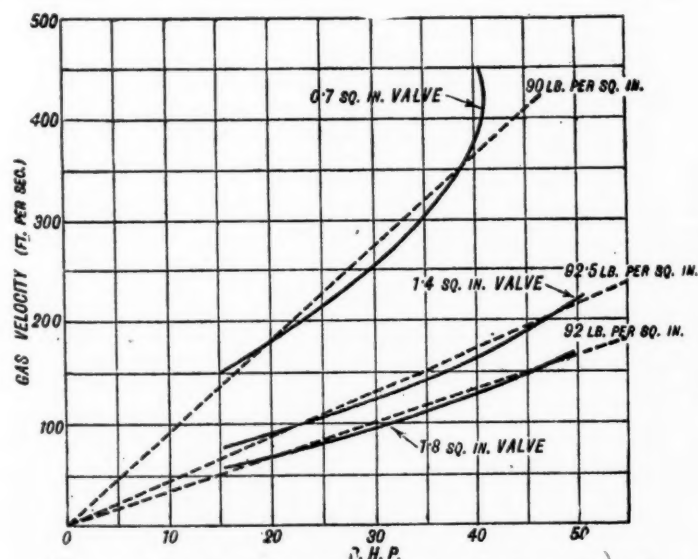


Fig. 1—Plotted values of inlet gas velocity and brake horsepower for engine A

speeds between 2200 and 2400 r.p.m. These figures show that the increase in brake horsepower is not proportional to the increase in valve area; in other words, the small valve is more useful per unit area than the large one.

With engine B the maximum brake horsepower is the same with both the larger sizes of valves, and is reduced by 20 per cent with the smallest valve of 0.7 sq. in. area.

Expressing brake horsepower in terms of valve area we have for engine B:

1.8 sq. in. valve.... 6.87 b.hp. per sq. in. of valve area  
1.4 sq. in. valve.... 8.97 b.hp. per sq. in. of valve area  
0.7 sq. in. valve.... 14.65 b.hp. per sq. in. of valve area

The maximum brake horsepower are in each case attained at 2400 r.p.m.

It will be noted that the maximum brake horsepower obtained in engine B with 0.7 sq. in. overhead valve is almost the same as that in engine A with 1.4 sq. in. valve of side-by-side design, the gas velocities being 220 ft. per sec. and 450 ft. per sec. respectively.

The reasons for this rather striking result arise from considerations which will be developed later.

TABLE II  
ENGINE B—FULL LOAD TESTS  
INLET VALVE AREA, 1.8 SQ. IN.

Revs. per Minute	B.H.P.	Compression, Lb. per Sq. In.	$\eta_p$ , Lb. per Sq. In.	M.E.P.* Calculated, Lb. per Sq. In.	Gas Vel., Ft. per Sec.	Fuel, Pints per B.H.P. per Hour
2,400	49.5	101	90	104	167	0.72
2,200	46.5	104	92	104	153	0.7
2,000	42.7	105	93	105	139	0.69
1,800	38.8	105	94	105	125	0.71
1,600	34.7	105.5	94.5	104.5	112	0.74
1,400	30.4	104	94.5	104.5	98	0.79
1,200	25.6	102	93	101.5	84	0.85
1,000	20.4	99	89	91.5	70	0.94
800	15.5	95	84.5	91.5	56	1.03

INLET VALVE AREA, 1.4 SQ. IN.

2,400	50.2	98	91	105	220	0.73
2,200	46.9	99	93	105	202	0.7
2,000	43.6	101	95	107	183	0.71
1,800	39.7	102	96.5	107	165	0.74
1,600	35.6	104	97	107	146	0.78
1,400	31.1	105	97	107	128	0.84
1,200	26	100	94.5	102.5	110	0.92
1,000	20.4	98	89	91.5	92	1.02
800	15.2	92.5	82.5	89.5	73	1.16

INLET VALVE AREA, 0.7 SQ. IN.

2,400	40.2	73	87	450	0.76
2,200	41	81	87	412	0.70
2,000	40	92.5	87	374	0.69
1,800	37.9	94	91.5	337	0.71
1,600	34.7	98	94.5	300	0.74
1,400	30.7	98	95.5	262	0.78
1,200	26.5	98	94.5	225	0.84
1,000	20.8	96	91	187	0.93
800	15.3	95	83.5	150	1.06

\*Calculated M.E.P. excludes fluid and pumping losses.

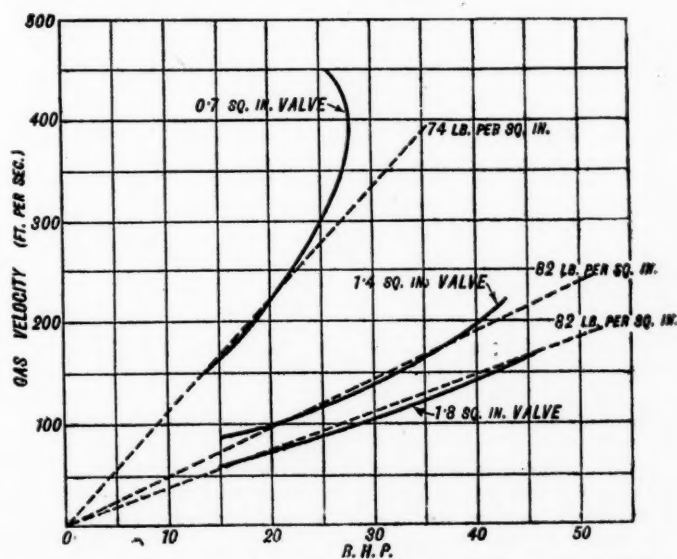


Fig. 2—Plotted values of inlet gas velocity and brake horsepower for engine B

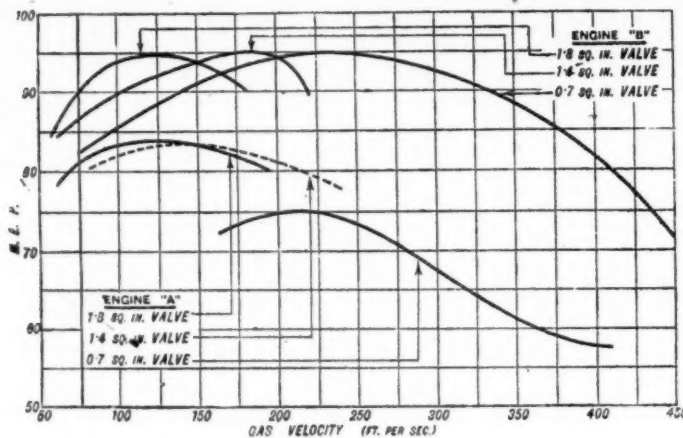


Fig. 3—Tabular and plotted values of inlet gas velocity and brake mean effective pressure for engines A and B

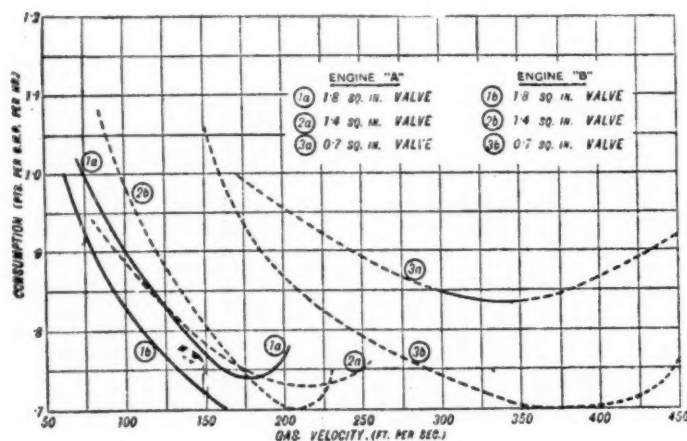


Fig. 4—Tabular and plotted values of improvement of fuel consumption

Further comparison of the maximum brake horsepowers obtained from engines A and B with valve areas of 1.8 and 1.4 sq. in. respectively show an increase of 10 per cent in maximum brake horsepower for engine A, but no increase for engine B, the increase in inlet gas velocities in each case being from 167 ft. per sec. to 220 ft. per sec.

The figures show, therefore, that in these engines the maximum brake horsepower obtained is very largely independent of the gas velocity through the inlet valve, and that for normal touring car engines much higher gas velocities can be used than are common practice without adversely affecting maximum brake horsepower.

#### Inlet Gas Velocity Has Little Effect on B.M.E.P.

**Deduction**—In the valve-in-head engine the effect of inlet gas velocity on brake mean effective pressure is much less than generally assumed, and B. M. E. P. of the order of 95 lbs. per sq. in. can be obtained with inlet gas velocities in the region of 300 ft. per second.

Referring to this Mr. Pomeroy said:

Tables I and II and Fig. 3 indicate the tabular and plotted values of inlet gas velocity and brake mean effective pressure for engines A and B.

To discuss these figures properly necessitates data as to the mechanical friction losses at the various speeds, so that inlet gas velocity may not be charged with a reduction in brake mean effective pressure due to mechanical friction.

The author has not been able to make such measurements, but data published on the friction losses of similar engines to those under discussion give figures which are probably near the truth.

Thus the mechanical friction losses (i.e., excluding pump- and fluid losses) are about as shown in Table IV.

The values of calculated mean effective pressure in Tables I and II are obtained by adding the appropriate allowance as shown above to the figures for brake mean effective pressure.

It will be seen that engine B is decidedly better in respect of mean effective pressure than engine A, but that in each case the calculated mean effective pressure is fairly steady at the various inlet gas velocities and does not fall off appreciably, i.e., more than about 5 per cent for gas velocities up to 300 ft. per second.

The author suggests that these results, particularly those obtained with engine B, show that the effect of inlet gas velocity on mean effective pressure is far less than is generally assumed.

The figures show also that brake mean effective pressures

TABLE III  
PART LOAD TESTS  
VALVE AREA, 1.8 SQ. IN.  
0.8 Full load

Revs. per Minute	B.H.P.	* $p_b$ , lb. per Sq. In.	Gas Vel. Ft. per Sec.	Engine A Fuel, Pints per B.H.P. per Hour	Engine B Fuel, Pints per B.H.P. per Hour
2,400	40	72.7	167	0.715	0.75
2,000	33.3	72.7	139	0.726	0.7
1,600	26.7	72.7	112	0.775	0.71
1,200	20	72.7	84	0.84	0.78
800	13.3	72.7	56	0.998	0.87

#### 0.6 Full load

2,400	30	54.5	167	0.8	0.76
2,000	25	54.5	139	0.827	0.75
1,600	20	54.5	112	0.882	0.80
1,200	15	54.5	84	0.967	0.87
800	10	54.5	56	1.17	0.98

#### 0.4 Full load

2,400	20	36.3	167	0.963	1.01
2,000	16.67	36.3	139	1.025	0.99
1,600	13.3	36.3	112	1.12	0.98
1,200	10	36.3	84	1.24	1.03
800	6.67	36.3	56	1.37	1.15

#### VALVE AREA, 1.4 SQ. IN.

#### 0.8 Full load

2,400	40	72.7	220	0.715	0.74
2,000	33.3	72.7	183	0.74	0.72
1,600	26.7	72.7	147	0.765	0.74
1,200	20	72.7	110	0.84	0.79
800	13.3	72.7	73	0.966	0.85

#### 0.6 Full load

2,400	30	54.5	220	0.845	0.86
2,000	25	54.5	183	0.837	0.78
1,600	20	54.5	147	0.89	0.82
1,200	15	54.5	110	0.975	0.88
800	10	54.5	73	1.125	0.96

#### 0.4 Full load

2,400	20	36.3	220	1.085	1.0
2,000	16.67	36.3	183	1.138	1.03
1,600	13.33	36.3	147	1.245	1.10
1,200	10	36.3	110	1.4	1.23
800	6.67	36.3	73	1.4	1.23

#### VALVE AREA, 0.7 SQ. IN.

#### 0.8 Full load

2,400	.....	.....	.....	.....	.....
2,000	.....	.....	.....	.....	.....
1,600	26.67	72.7	300	0.835	0.71
1,200	20	72.7	225	0.885	0.88
800	13.3	72.7	150	1.026	0.9

#### 0.6 Full load

2,400	.....	.....	.....	.....	.....
2,000	25	54.4	374	0.9	0.88
1,600	20	54.5	300	0.909	0.83
1,200	15	54.5	225	1.01	0.89
800	10	54.5	150	1.16	1.01

#### 0.4 Full load

2,400	20	36.3	450	1.08	1.01
2,000	16.67	36.3	374	1.07	0.96
1,600	13.3	36.3	300	1.13	0.99
1,200	10	36.3	225	1.24	1.05
800	6.67	36.3	150	1.43	1.13

TABLE IV.

Revs. per minute	Mechanical friction per sq. in. of Piston Area
2,400	14
2,000	12
1,600	10
1,200	8
800	7

of the order of 95 lb. per sq. in. can be obtained with inlet gas velocities in the region of 300 ft. per sec.

#### Fuel Consumption Not Related Directly to Inlet Gas Velocity

##### A—Full Loads

**Deduction**—Improvement in fuel consumption is related to increase in engine speed rather than to increase in gas velocity as such.

Mr. Pomeroy analyzed his data:

Tables I and II and Fig. 4 indicate the tabular and plotted values of these quantities for both engines.

The characteristic feature of all the curves is that the consumption per brake horsepower per hour rapidly falls with increase in the inlet valve gas velocity, but rises again with further increase in gas velocity as the upper limit of revolution speed is reached. Further study of the curves shows that the downward path of each curve is approximately inclined to the horizontal in such a way that the improvement per cent in consumption is proportional to the increase per cent in inlet gas velocity. *In other words, the improvement in consumption is related to increase of engine speed rather than to increase of gas velocity as such.* This aspect of the case will be discussed later.

It is well known that turbulence, i.e., violent agitation of the mixture at the instant of ignition, is essential for both power and economy; it is usually regarded as a function of inlet gas velocity, so that it is of interest to see if any improvement in fuel consumption can be associated with increase in gas velocity. An examination of the curves in Fig. 4 shows that the same consumption in the different cases is attained with very differing values of gas velocity.

It may be said, therefore, that there is either no apparent increase in efficiency with the higher gas velocities or that there is no apparent decrease in efficiency with the lower gas velocities.

It would seem that, in considering turbulence, inlet gas velocity must be considered in its relation to revolution speed or piston speed, and that there is a certain minimum relation between the two which produces the necessary turbulence for approximately complete combustion at all speeds.

From these experiments it seems reasonable to believe that this minimum is secured with the largest valves used at the lowest speeds of the tests. It will be of great interest if the discussion reveals any experiments of this kind upon similar engines but run at lower engine speeds.

The conclusions formed by the author in considering these results are:

1. That consumption is not related directly to inlet gas velocity.
2. That sufficient turbulence is developed to produce approximately complete and rapid combustion at quite low gas velocities.
3. That the improvement in consumption with increase of inlet gas velocity shown by the curves is related to revolution speed and not to gas velocity as such.

Table III shows the consumption of each engine at varying loads and speeds for each area of inlet valve.

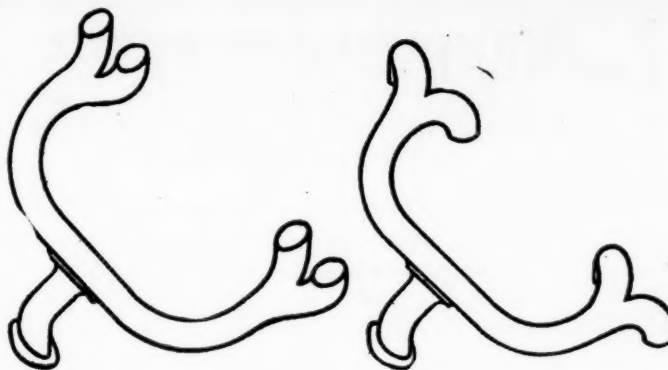
It will be seen that there is no great difference in consumption in each corresponding series of figures relating to the tests with inlet valves of 1.8 sq. in. area except at the lower speeds at 0.6 and 0.4 of full load, where engine B is decidedly better than engine A. The same remark applies to the tests with inlet valves of 1.4 sq. in. area.

Comparing the tests at 0.8, 0.6, and 0.4 full load when using each size of inlet valve, it is evident that there is no marked effect which can be attributed to variation of inlet gas velocity.

For example in Table V:

TABLE V.

	Inlet Valve Areas		
	1.8 sq. in.	1.4 sq. in.	0.7 sq. in.
Average consumption of engine B in pints per B.H.P. per hour between 800 and 2400 revs. per minute.....	0.82	0.86	0.83
Full load.....	0.78	0.78	0.76
0.8 full load..	0.82	0.85	0.88
0.6 full load..	0.94	1.06	1.02
0.4 full load..			
Average gas velocity, ft. per second.	111	146	300



Figs. 5 and 6—Carbureters used on each engine were similar in each case

Those who are accustomed to making measurements of fuel consumption in bulk, so to speak, will appreciate the fact that the small variations shown as between the one valve area and another are easily accounted for by errors in measurement.

The fuel consumption measurements were made by running the engine for a period required to use 0.5 pint of fuel, and as a rule the figures given are the average of three runs. The difficulties, however, of keeping the engine speed and load constant were very appreciable at the lower speeds, as these occupied much time.

The author would point out that the consumptions at full load are higher than those at 0.8 full load. This increase in consumption at full load, compared with 80 per cent of full load, occurs so frequently that it cannot be accidental. It is not in the author's opinion easily explicable, and he hopes the discussion will throw some light on the point. It does not appear to be connected with revolution speed or gas velocity, but simply arises in the process of getting the last ounce out of the engine.

In view of the small range of difference in consumption in these part-load tests it has not been thought worth while to plot the curves showing gas velocity and consumption at the various speeds and valve areas.

The general conclusion drawn from an examination of the results shows that the fuel consumption per brake horsepower per hour is not materially affected by the use of either the largest or smallest inlet valves. In other words, it is not affected by the inlet gas velocity at any prescribed number of revolutions per minute.

The author has now briefly considered the various factors in engine performance of brake horsepower, brake mean effective pressure and fuel consumption with respect to inlet gas velocity.

The experimental evidence obtained from the tests shows that within much wider limits than are usually accepted, inlet gas velocity does not appreciably affect performance either in respect of power or consumption.

The author would emphasize the fact that the range of engine speed applying to these tests is that which is more applicable to touring car engines than to racing engines. In view of his experience with the latter he would not extend the above conclusions as to the effect, or rather non-effect, of inlet gas velocity on maximum power.

So far nothing has been said about exhaust valve effects. In all the tests on engine B the author is quite sure that the area of the exhaust valve was such as to produce no back pressure or exhaust choking effect. This engine had, in fact, two exhaust valves. Whether both were in use or only one made not the slightest difference in any of the experiments made on this point. Only one exhaust valve was used throughout all the experiments. With regard to engine A there is room for doubt as to whether the exhaust was sufficiently free with the 0.7 sq. in. valve area, but for the larger sizes of inlet valve the author is confident that the exhaust valve was adequate.

The carbureters and the induction pipes used on each engine were similar in each case, and are shown diagrammatically in Figs. 5 and 6.

(To be continued)

# AUTOMOTIVE INDUSTRIES

*AUTOMOBILE*

PUBLISHED WEEKLY  
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Vol. XL Thursday, February 20, 1919 No. 8

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Entered as second-class matter Jan. 2, 1903, at the post-office at New York, New York, under the Act of March 3, 1879.

Member of the Audit Bureau of Circulations.

\*Automotive Industries-The Automobile is a consolidation of The Automobile (monthly) and the Motor Review (weekly), May, 1902, Dealer and Repairman (monthly), October, 1903, and the Automobile Magazine (monthly), July, 1907.

## Support for Highways Development

**R**OADBUILDING, at a standstill during the war because of lack of materials, now promises to outstrip all past records in the history of highway construction in this country. Appropriations already made and bills pending give assurance that an appreciation of the value of good roads has come out of the war, that the work of the various associations at Washington, the request of President Wilson and the activities of the Highways Transport Committee are bearing fruit.

That the manufacturers are interested in good roads goes without saying. The increased business that can result both to car and to truck makers from a network of highways is well recognized.

The National Automobile Chamber of Commerce, awake to the situation from its angle, has already established a representative at Washington to look after the highways developments. But the indi-

vidual manufacturers at this time should also engage in every manner possible to further the work.

Advertisements, salesmen, agents, dealers and every agency should to a reasonable extent be used to promote the building of highways now while legislators and the public both seem completely "sold" on the value of "good roads everywhere."

## Limit Tire Sizes Gradually

**O**NE of the governmental war restrictions important both to industry and to war was that limiting the sizes of tires, and the recent decision of the manufacturers to resume manufacture of all sizes demanded should be temporary only.

Undoubtedly many car makers would suffer heavy losses if suddenly forced to meet the manufacturing conditions created by the tire size limits. But the reduction of tire sizes from more than 200 of the pneumatic types to 9 and from more than 100 solids to 14 is too efficient a plan to be dropped entirely. It simplifies manufacture, labor and factory problems too well to be given up merely because of the temporary expense involved.

The best course would be one allowing a very gradual elimination of tire sizes and making the change less abrupt than that planned by the War Board, allowing the car makers to adopt the standard sizes as they change models, and giving the public sufficient time to consume those cars using tires that will eventually become obsolete.

## Individual Truck Control Means Inefficiency

**A** REVERSION to pre-war methods of scattered purchase, operation and maintenance is threatened by the new Army Bill which has made no appropriation for the Motor Transport Corps and provides for the discontinuance of that body by the repeal of the Overman Act under which it was created. Appropriations as made for trucks are given to each individual division of the army.

This means that each department will again purchase the sizes and types of trucks it desires without regard to interdepartment standardization. There will no doubt again be hundreds of types in use and thousands of different parts in stock for maintenance and repair.

The present return to pre-war individualism of departments points to inefficiency of truck operation, increased costs in maintenance, and a breaking up of esprit de corps so essential in motor transport work.

The plan now considered and provided for by the bill means confusion, waste, extravagance and inefficiency. It means duplication of buying, operation and maintenance effort and lack of that single control that provides for comprehensive operation of truck convoys, repairshops and training schools.

The Army Bill must be amended to provide properly for the continuation of the Motor Transport Corps or it must in some other manner place all motor transport under one directing head.

## Dirigibles for Commercial Flights

THE discussion of commercial possibilities of aircraft presupposes a careful differentiation between lighter-than-air types, such as dirigibles, and the heavier-than-air machines, such as airplanes. At present too many are inclined to think that because the airplane proved itself such a potent factor in war it will entirely dominate the field of commercial aircraft. The failure of the Zeppelins as war machines must not lead to the rejection of this type for commercial uses. The Zeppelin was a war failure owing to the inflammable gas it carried and because of the large target it offered to the attacking airplane. In peace both of these handicaps disappear, and the dirigible must be generally considered in analyzing the future of commercial aviation.

These are days when the enthusiast is apt to make hasty deductions regarding commercial aviation. The fact that the passenger airplane might cross the Atlantic should not be looked upon as more than a daredevil demonstration. Those who would immediately begin organizing a transatlantic mail service because of such a demonstration would be working an injury to the future of commercial aviation.

On the other hand, a war demonstration of Allied army dirigibles has been sufficient to point definitely to the possibilities of those craft for commercial uses. For transatlantic work, so far as conditions can be judged to-day, there is no possibility of comparison between the dirigible type and the airplane type. The dirigible looks like the practical vehicle for this ocean service, for at present there are dirigibles in existence in Great Britain and possibly in France, as well as in Germany, which could make a two-way ocean trip without the necessity of landing. These dirigibles have great carrying capacity. With such a positive form of aerial transportation now in existence, it seems foolhardy to attempt the uncommercial field of the airplane for such great distances.

In commercial aviation, as in any other industry that has to be built on some fundamentals, the mind must rule and not the heart. Perhaps crossing the Atlantic in an airplane appeals amazingly more to the imagination than crossing it in a dirigible, but from a financial point of view the other does not admit of comparison. To-day there is entirely too much enthusiasm for commercial aviation and too few analyses of what the requirements are before commercial aviation can be started.

What is the use of organizing large companies for commercial transportation by airplane without first having the necessary where-with-all with which to carry on such an organization? We cannot operate a railroad without the right of way, stations, telegraph lines, freight houses, and other physical equipment. An aerial transport system cannot be operated without a parallel set of physical requirements. To make it possible to fly an airplane from New York to Chicago there must be landing fields, and it would be utterly impossible to start a commercial line of aircraft transportation between the two cities without a completely perfected scheme of landing fields. Nobody knows definitely how far apart these landing fields should be, but the consensus of opinion of those who have made a close study of it abroad think that 10 to 15 miles is the maximum distance between landing grounds, and that there should be larger airdromes at other intervals. These students of commercial aviation are of the opinion that no plane should be flown more than 300 miles even in commercial use without landing. This finds a parallel in the short-run of the railroad locomotive which has been necessary in railroad operation.

In addition to the continuous chain of landing fields, there is other equipment necessary before a line of commercial aviation could be successful. The entire area must be properly marked with signals so that the aviator can follow the course by day or by night. This calls for some form of electric signals by night, not only on the course, but off it. Imagine the difficulty of an aerial pilot who found himself some night wide of his course due to high winds, and because of low clouds taken entirely out of contact with the course and the signals. It would mean almost certain destruction to the pilot and his load.

There is also need for a complete wireless system, not only on the planes, but on the landing fields, and also over much of the adjacent territory. This calls for a comprehensive course in aerial navigation and the pilot must be schooled in it as thoroughly as the sea captain of to-day.

Commercial aviation is confronted with other problems that must be solved before the work can be a success or even a warrantable business venture. Climatic conditions change very greatly in a distance of 250 miles, and a complete meteorological system is necessary, together with a

(Continued on page 447)

# Latest News of the

## Foreign Import Restrictions Continued and Increased American Makers Must Overcome Serious Problems—Most Important Countries Have Restrictions

WASHINGTON, Feb. 18—That American manufacturers must seriously consider the existing restrictions and embargoes on the importation of automotive products in the important foreign countries of the world is evidenced more clearly daily as these restrictions become more severe.

A summary of the foreign import restrictions shows clearly the difficulties and obstacles of the American exporter. Few of the important countries are without some form of severe restrictions. A complete prohibition is in force in the United Kingdom. A duty of 70 per cent applies to lower priced cars in France, and import licenses which are required are only rarely granted. The unfavorable currency exchange conditions in Italy and the United States form a barrier to exports to that country. Likewise restrictions in the Scandinavian countries, the Netherlands, Switzerland, Australia, Canada and the British West Indies display the need for finding a solution to the problem. There are no American restrictions on the exports of automobiles or other automotive products.

Following is the latest available list of foreign import restrictions, together with a summary of the import and export situation as revealed by recent War Trade Board announcements:

### UNITED KINGDOM

A prohibition in force in the United Kingdom against the importation of motor cars, chassis, motorcycles, and parts and accessories of motor cars and motorcycles (other than tires) is based on two orders of March 21 and June 27, 1916, both of which are still in effect. Rubber manufacturers, including tires, have been prohibited since May 10, 1917, and agricultural machinery, including tractors, since Feb. 23, 1917. It is to be observed that when licenses are granted for the importation of passenger motor cars they will be subject to a duty of 33½ per cent ad valorem. In determining the duty payable the value of tires is excluded.

### FRANCE

Import licenses are still required for the importation of automobiles and motor trucks, motorcycles, and tractors into France and Algeria. When licenses are exceptionally granted for automobiles the special rate of 70 per cent ad valorem will apply to such vehicles when weighing less than 2500 kilos.

### FRENCH COLONIES

The French prohibitions are not automatically extended to the French colonies, but the Government of Tunis is understood to

have adopted prohibitions in practically the same form as in France.

### ITALY

All goods imported into Italy from the United States require import licenses, and by reason of the unfavorable exchange conditions it is improbable that any modification will be made in the near future.

### SCANDINAVIAN COUNTRIES

By reason of the special arrangements entered into between the Allied Governments and the United States and the Scandinavian countries, import licenses from the respective governments or government associations are required before the United States export licenses will be issued.

### NETHERLANDS

All goods, including automobiles, must be consigned to the Netherlands Overseas Trust.

### SWITZERLAND

Motor cars shipped to Switzerland require import licenses and must be consigned to the S. S. S.

### AUSTRALIA

Automobiles are admitted into Australia only when each body is accompanied by two chassis. No prohibition is in force against the importation of motor trucks, farm tractors, or motorcycles.

### CANADA

Automobiles for passenger use or susceptible of passenger use, when costing over \$1,200 f.o.b. factory, are not admitted from the United States, Newfoundland, St. Pierre and Miquelon and the United Kingdom. All automobiles from other countries are prohibited. There is no prohibition on tractors, trucks, or motorcycles.

### BRITISH WEST INDIES

There is still in force a prohibition against the importation of motor vehicles in Trinidad, the Leeward and Windward Islands, and British Guiana. This prohibition applies also to bicycles, tricycles, and all classes of motor vehicles. It is doubtful, however, whether it would extend to tractors.

### OTHER COUNTRIES

Practical difficulties prevent the shipment of automobiles or other motor vehicles to Finland and Russia. There are no restrictions against the importation of motor vehicles in the Union of South Africa or Egypt. The following countries have recently removed their restrictions against importation of motor vehicles: Belgium, British India, Straits Settlements, and Federated Malay States. There is no prohibition against the importation of automobiles into Ceylon, but the prohibitive duty of 100 per cent ad valorem is understood to be still in force.

The War Trade Board will grant licenses freely for the export of automotive products to all nations providing that the applications are otherwise in order. The board does not

guarantee that the issuance of the licenses will permit the entry of the car into the foreign country. It advises all manufacturers to depend entirely upon their representatives in each country. The reason for this is chiefly that the restrictions of the different nations are changed so rapidly that the War Trade Board cannot follow them closely and does grant licenses freely only because automotive products are not on the conservation list.

Exports which have been prohibited to some nations during the war are gradually resuming. The War Trade Board expects shortly to announce that shipments can be made to Finland. It is probable that there will be an inter-Allied Committee at Helsingfors which will pass upon all imports from this country. American exporters who are interested in trading with Finland are advised to communicate with their correspondents there as soon as possible and request them to get in touch with the American Consul at Helsingfors. Trade can now be resumed by American exporters with Serbia and Rumania. Export licenses will be necessary but will be granted freely under the same conditions as for other European countries. The board has received no official advice as to what import regulations may be in force in Serbia and Rumania and exporters are advised to communicate with their customers abroad before making shipments. Import restrictions to Belgium have been revised and have been eliminated as regards all automotive products. Applications for all import licenses should, if possible, be made by representatives of American firms in Belgium. Restrictions against the importation of rubber tires into Norway, Sweden, Holland, and Denmark have been lifted and licenses will now be granted freely, subject only to the condition that the proper import certificates have been issued.

Allotments of shipping space have been made by the Shipping Board for the East Coast of South American trade, which will be sufficient to take care of all of the cargo offered in the immediate future for these markets. For this reason the shipping preference procedure and priority system will no longer be necessary and manufacturers of automotive products, it is expected, will find ample space for their exports to the Southern continent.

### Sub-Contractors Holding Up Contract Settlements

DETROIT, Feb. 18—Sub-contractors of war material are not making proper efforts to secure the settlement of their claims, declares J. J. Crowley, president of the Michigan section, National Association of Manufacturers of War Materials. Figures received from Washington show that the Ordnance District Board in Detroit has 276 contracts to settle, of which only 82 have been presented to the board by the contractors. Contractors declare they are delayed because their sub-contractors are negligent in making speedy returns. Of the 82 claims presented, 12 have been allowed.

# Automotive Industries

## France Prohibits Auto Imports

Embargo Against Automobile Imports for One Year—Importers Object

By W. F. Bradley

PARIS, Feb. 6—The importation of automobiles into France has been forbidden for about one year. Previous to this, motor vehicles were only admitted on payment of a 70 per cent duty. French automobile manufacturers, as a class, are satisfied with the present conditions, for, as they have not yet returned their factories completely to peace conditions, the prohibition of imports removes all foreign competition.

Importers, and particularly those who were established in France before the war, are very dissatisfied. At the present time there is a strong demand for all kinds of automobiles, and, as the home manufacturers cannot possibly meet this demand, the general public would not be displeased to see foreign cars brought in. The most important phase of this situation is what attitude France will adopt with regard to the importation of foreign cars. If, as many of the manufacturers request, the 70 per cent duty is maintained for a long period, very few, if any, foreign automobiles can be sold in France.

Although the cry for a 70 per cent duty is still strong, it is not heard as persistently as was the case a few months ago; probably makers are beginning to realize that they cannot erect a high tariff wall to protect themselves without other nations doing likewise. As France, before the war, was the greatest motor exporting nation in the world, and as her productive ability has enormously increased during the war, it is important that she should find outlets in foreign markets; it is hardly likely that she will get this free outlet if she protects her own market with a practically prohibitive import duty. Only one French manufacturer of any importance has loudly denounced the folly of the 70 per cent proposition. This is André Citroën, who has only recently entered the automobile industry and who, during the last few days, has issued all particulars regarding his program.

The man responsible for the present prohibition of automobile imports is M. Loucheur, Minister of Reconstruction. It is well known that pressure from all quarters has been brought to bear, but the ministry, of which M. Loucheur is the head, has persistently refused to admit any change.

The negotiations between automobile importers and the French Government were of a private nature until to-day, when, breaking away from the previous line of action, the Ford Motor Co. of France has come out with a half-page advertisement in the *New York Herald* in which the whole situation is explained in detail. The Ford Motor Co. shows that not only has M. Loucheur persistently refused to allow any foreign automobiles to be brought into France, but at the present time he will not allow Ford automobiles lying idle at the docks to go into service despite the very urgent need for supplementary transportation.

It appears that the Tardieu Commission purchased about 8500 Ford automobiles at a cost of approximately \$375 each, delivery for export at American ports. About 4500 of these automobiles are new and have never seen service; they comprise 3500 that have not yet been delivered from the Ford company's works at Bordeaux, and 1000 which have been delivered and until recently were lying in automobile parks at Bordeaux and Versailles. The Ford company suggests that the French Government should release or sell back to them these 4500 cars at the price paid by the Government, plus a payment of \$38, which payment could be considered either as profit or to cover cost of ocean transportation.

The Ford company proposes to sell these cars in France to customers who are in immediate and urgent need of them, such as doctors, veterinary surgeons, commercial firms, etc. In addition to paying for the automobiles at the cost and plus the profit before said, the Ford company also proposes to pay 70 per cent ad valorem duty on the above price of \$375 and the purchaser would also pay 10 per cent luxury tax on the retail selling price of the vehicles. The selling price would be \$1,300. It may be mentioned that this price is very high for a Ford car, but there is no doubt that the 4500 automobiles could be disposed of in France immediately on these conditions.

The Ford company points out that the following advantages would accrue to the French Government by accepting their proposal:

- 1—Immediate cessation of the cost of maintenance, housing, etc., 4500 cars.
- 2—Complete immunity from any possible loss in respect thereof.
- 3—Resumption on the basis of established law of commercial business amounting to a total turnover exceeding 32 million francs.
- 4—Receipt by the French Government of custom duty and luxury tax amounting to 8,831,250 francs.
- 5—Receipt by the French Government

(Continued on page 450)

## To Make All Sizes of Tires

Makers to Abolish War Tire Limits—All Sizes Demanded to Be Made

NEW YORK, Feb. 19—The limits set on the manufacture of tires by the War Industries Board during the war will not be followed in the future, and all sizes of tires demanded by the public will be manufactured, according to an announcement by the National Automobile Chamber of Commerce, made public to-day.

This decision followed a meeting of tire and automobile makers in Detroit late last week. The restrictions placed on tire manufacture by the War Industries Board in an effort to conserve rubber, labor and factory facilities in the spring of 1918 called for a reduction of pneumatic tires from a range of 200 sizes and types to nine sizes and types, the reduction to be made over a period of two years. Truck tires were reduced by a similar order from over 100 types and sizes to fourteen, affecting chiefly those tires used on 1- and 2-ton trucks.

The representatives of the N. A. C. C. and the tire industry, present, agreed also that for the time being it will be most wise to continue export of tires in metric sizes only, as has been the custom. This question of shipping tires abroad marked similarly to those used in this country for domestic consumption is to come again in the near future when members of the tire industry will confer with J. Walter Drake, chairman of the tire committee of the N. A. C. C.

The decision to manufacture all sizes of tires regardless of the War Industries Board rules followed the discovery that 2,000,000 32 x 4 tires, for example, were needed with 1,000,000 for equipment of 200,000 cars in process of manufacture and 1,000,000 for maintenance. This was one of the sizes that were to be abolished. Similarly other sizes were found necessary; hence the decision to make all sizes demanded.

### Hanch Sails for Europe

NEW YORK, Feb. 17—C. C. Hanch, formerly chief of the Automotive Section, War Industries Board, sailed to-day for Paris, where he will attend the Inter-Allied Council of Automobile Manufacturers meeting on March 5 as the representative of the National Automobile Chamber of Commerce. He will also investigate industrial and trade conditions.

## Nation Awakens to Worth of Good Roads

States Appropriate Millions for Highways—Nation-Wide Acceptance of Need for Improved Roads—\$200,000,000 Available for That Purpose This Year

WASHINGTON, Feb. 17—A nation-wide ambition for a complete network of good roads and highways through the country is evidenced by reports received here of State appropriations for highways, and by the popular approval that has been expressed in favor of the National Highway bills now before Congress.

It appears that, as a result of the work of the various associations, the expression of President Wilson in favor of good roads, and the activities of the Highways Transport Committee during the war, the plan for good roads has suddenly become crystallized in the minds of the entire country.

### \$200,000,000 Available

Reports received here indicate that all of the States are considering road appropriations, and several have already passed the necessary bills for funds covering the next few years.

Minnesota has appropriated \$100,000,000, South Carolina, \$40,000,000; Illinois, \$60,000,000; Pennsylvania, \$50,000,000; Georgia, \$40,000,000; Colorado, \$20,000,000, and Alabama, \$10,000,000, to be used in conjunction with the funds appropriated by the 1917 Federal Road act for the development of the highways.

It is estimated that between \$200,000,000 and \$300,000,000 will be available for highways during 1919. The Federal Road act appropriated \$5,000,000 in 1916-17, \$10,000,000 in 1917-18, \$15,000,000 in 1918-19, a total of \$30,000,000, of which \$1,487,336 has been actually paid out by the Treasury, and a total of \$10,303,379 has been set aside.

### 827 Road Construction Projects

Eight hundred twenty-seven projects for road construction have been submitted to date, of which 760 were approved at an expenditure of \$21,112,795.30 of Federal funds and \$35,069,051.42 of State funds, a total of \$56,171,846.72. These funds are for projects covering 7869 miles. The money actually expended to date was for ten projects of forty-four miles, which have been completed. The reason for the delay in completion of highways and for the small amount actually expended is the war, during which it was impossible to use freight cars or secure materials for highway construction.

The new Bankhead bill, which will probably be passed by Congress, and which has already been passed by the Senate, provides for \$200,000,000, with \$50,000,000 available at once for 1918-19, \$75,000,000 in 1919-20 and \$75,000,000 in 1920-21. This bill, which has been described in these columns before, is practically an amendment and continuation of the original Federal Road act of 1916. The States must provide appropriations

### Good Road Slogans Prepared by Department of Labor

"Build now the National, State and County Roads we need, and Prosperity will ride to every American's gate.

"Build Now Good Roads where they are needed, so that Good Times can come to every American's home without delay.

"Build Now—Money spent wisely for Good Roads will come back because the roads will bring it back.

"Build Now Good Roads and see how quickly Good Times will roll down these roads.

"Build Now—You can Notice the earmarks of Prosperity along Good Roads."—W. B. WILSON, Secretary of Labor.

on a dollar for dollar basis to secure their share of the National funds.

In consequence of the Bankhead bill and funds already available, there will be at least \$200,000,000 to be expended in 1919 if the States comply immediately with the conditions of the Federal Road act and provide the dollar for dollar State funds.

Of the \$30,000,000 originally appropriated by the Federal Road act, \$20,000,000 are still available, and in addition there are \$35,000,000 appropriated by States which are still available, making a total of \$65,000,000.

Fifty million dollars are appropriated by the Bankhead bill for 1919, and an additional \$50,000,000 will be voted by the various States, making a total of \$100,000,000. Consequently there will be \$150,000,000 available in 1919, and as the States usually exceed the dollar for dollar basis by 50 per cent, it is probable that the total sum available will be over \$200,000,000.

The National Highways Commission bill, which was the result of the Highways Association meeting in Chicago, is to be rewritten to meet the legal requirements. This bill may be presented at this session of Congress or may be held over until the next session, depending upon the opportunities presented. It is quite certain that, even though presented at this session, it will not be considered until some future date.

Other Government departments besides the Department of Agriculture are also displaying an interest in road construction. The Department of Labor is seriously considering it as a means of employment for soldiers returning from the

army camps, and is planning a slogan campaign in conjunction with the American Federation of Labor. The slogans will be advertised throughout the country intensively so that they reach every community and home.

### N. A. C. C. Roads Committee Secretary at Washington

WASHINGTON, Feb. 17—Pyke Johnson, a former newspaper man of Denver, Col., has been made the secretary of the Roads Committee of the National Automobile Chamber of Commerce, with headquarters at the Washington office of the National Automobile Chamber of Commerce. He will compile road data and watch the development of highway legislation.

### Michigan Launches Campaign for Road Amendment

LANSING, Feb. 18—A campaign to insure passage of the \$50,000,000 good roads amendment, which has passed both Houses of the Legislature and will come before the voters at the April election, has been launched by the Michigan Association of Road Commissioners and Engineers. In connection with automobile clubs and good road associations throughout the State, they will conduct an intensive campaign to reach every man and woman elector with circulars and speakers.

### 106,930 Army Trucks in 1918

WASHINGTON, Feb. 17—One hundred and six thousand, nine hundred and thirty trucks and passenger cars were completed for the United States Army in 1918, according to a report issued by the War Department. Of this number, 89,277 were trucks, ranging from ½- to 5-ton, and 17,653 were passenger cars. Total probable production for military use for 1919 will include 28,694 trucks and passenger cars, of which 28,679 will be trucks and fifteen passenger cars.

Following is the total production for 1918, and the probable production for 1919, in sizes:

Trucks and Passenger Cars Completed During Year 1918 for the War Department		Probable Production for 1919 for War Department
½ ton trucks....	3,454	0
¾ ton trucks....	7,260	0
¾-1 ton trucks..	2,474	0
1 ton trucks....	16,363	6,805
1½ ton trucks....	3,095	2,268
1½ to 2 ton trucks	8,977	1,385
2 ton trucks....	14,415	3,369
3 ton trucks....	28,073	12,627
3½ ton trucks....	672	961
4 ton trucks....	1,888	362
5 ton trucks....	2,465	468
5½ ton trucks....	3,141	434
Passenger cars..	17,653	15
Total.....	106,930	28,694

### Atterbury Capital Doubled

BUFFALO, Feb. 15—The Atterbury Motor Car Co. has increased its capital from \$250,000 to \$500,000 to increase production facilities.

## DePalma Smashes Speed Records

Sets New Pace for 1 to 20-Mile Straightaways in Packard with Aviation Engine

DAYTONA BEACH, FLA., Feb. 18—Ralph DePalma broke all previous records for speed for distances from one to twenty miles, including those made by Burman in 1911 over the same course. Driving a Packard, equipped with a 12-cylinder, 4 x 6 aviation engine, he made his record in all instances, except that one-mile stand start, with flying starts. The engine used has a piston displacement of 904.8 cu. ft. The car was equipped with but one seat. Fuel used was gasoline seventy-nine Baume.

On Feb. 12 DePalma made a 1-mile and 1 kilometer record. On Feb. 16 and 17 he hung up records for all distances up to 20 miles, including a 1-mile standing start, formerly held by Barney Oldfield. All of these figures have been certified by the contest board of the A. A. A.

DePalma completely re-equipped his car in New York with Lynite pistons, Hartford absorbers, Goodyear tires, Willard battery and Boyce motometer. DePalma's new records compared with former records follow:

De Palma's New Records				Old Records			
Date	Distance	Time	M. P. H.	Date	Time	M. P. H.	Driver and Car
Feb. 12, 1919	1 mile	24.02 sec.	149.8	1911	25.40 sec.	141.7	Burman, Benz
Feb. 12, 1919	1 kilometer	14.86 sec.	140.9	1911	15.88 sec.	140.8	Burman, Benz
Feb. 17, 1919	*1 mile	38.83 sec.	92.7	1910	40.53 sec.	88.8	Oldfield, Benz
Feb. 16, 1919	2 miles	49.54 sec.	145.3	1911	51.28 sec.	140.4	Burman, Benz
Feb. 16, 1919	3 miles	1:15.04 min.	143.9	.....	.....	.....	.....
Feb. 16, 1919	4 miles	1:39.77 min.	144.2	.....	.....	.....	.....
Feb. 16, 1919	5 miles	2:04.78 min.	144.2	1906	2:34 min.	116.8	Hemery, Darracq
Feb. 16, 1919	10 miles	4:09.30 min.	144.3	1909	5:14.40 min.	114.5	Bruce-Brown, Benz
Feb. 17, 1919	15 miles	6:48.55 min.	132.1	1906	10 min.	90	Lancia, Fiat
Feb. 17, 1919	20 miles	8:54.20 min.	134.7	1911	13:11.92 min.	90.9	Burman, Buick

\*Standing start.

### Grand Rapids Show This Week

GRAND RAPIDS, Feb. 17—The 1919 show of the Grand Rapids Automobile Business Association is being held this week, having opened to-day. It is being staged in the Klingman Building. There are fewer dealers listed in the list of exhibitors, but in spite of this more cars and trucks are on display than ever before.

### Des Moines Tenth Annual Show Opens

DES MOINES, Feb. 18—The tenth annual motor show opened to-day at the local plant of the Ford Motor Co., which affords four times as much space as has been available in previous years when the show was held in the Coliseum. Iowa is flocking to the show, and as a result of last year's bumper crops is better than ever able to buy automobile goods. Sixty-four exhibitors hold space. Over 200 different models representing forty-eight makes of cars are included in the exhibit, which is the largest ever held in Iowa. Trucks and tractors are a new feature. There are thirty-five makes of

trucks on display and eighteen makes of tractors.

### Dayton Automobile Show March 3

DAYTON, Feb. 17—Dayton will hold its annual automobile show March 3-9. Plans for the big event are about complete. Every type of car will be exhibited at the show as well as a complete line of accessories and equipment. As airplanes and tanks are made in Dayton an effort is being made to secure one of each for the show. The exhibition hall, building No. 21 of the National Cash Register plant, provides 80,000 ft. of floor space and is 540 ft. in length. It is expected that \$500,000 worth of automobiles and accessories will be on exhibition.

### Shipping Board Aids Lyons Fair Exhibitors

WASHINGTON, Feb. 18—The United States Shipping Board has arranged to provide shipping space for all American exhibitors at the fourth annual Lyons Sample Fair to be held from March 1-15. The fair, endorsed by the Departments of State and Commerce, is under the patronage of the President of France. The first fair was held in 1916 with 1324 exhibitors. In 1917 there were 2593 and in 1918 3182 exhibitors. The first year's business totalled \$19,000,000, while at the third

fair it amounted to \$150,000,000. There were 527 American exhibitors at the third fair.

The Railroad Administration will also aid exhibitors insofar as is necessary to insure quick delivery of samples to the seaboard. The charges for space at the exhibit are \$110 per 20 sq. yd. Passports will be granted freely by the Department of State to all bona fide exhibitors and representatives.

### Toronto Show in March

TORONTO, Feb. 17—The Ontario Automobile and Accessories Branch of the Retail Merchants' Association will hold its second annual convention on March 6-7, in Toronto. The meetings will be held in Foresters' Hall, and an exhibit of accessories and tires will be held in the basement.

### General Tire & Rubber Co. Expands

AKRON, Feb. 18—The General Tire & Rubber Co. has increased its capitalization from \$1,000,000 to \$2,500,000.

## Chandler Officials in New Company

Cleveland Automobile Co. Will Produce Low-Price Car—Production by August

CLEVELAND, Feb. 17—Officials of the Chandler Motor Car Co., this city, are interested in a new organization to build a low priced car. The new concern will be known as the Cleveland Automobile Co. and the car as the Cleveland. The company is incorporated under the laws of Delaware, with an authorized capital stock of \$1,400,000. F. B. Chandler, president, and Samuel Regar, treasurer of the Chandler company, and Hornblower & Weeks New York bankers, are the leaders of the organization of the new concern, which will be identified very closely in personnel with the Chandler company. The car will be manufactured in an entirely separate factory, however, and it is expected that building will commence within 10 days on the new plant. It is proposed to be in production during the early part of the coming summer. Officials of the Cleveland company state that they have not been able to determine exactly on the price at which the new car will sell, this depending upon factory costs after getting into production. It is stated, however, that the price will be materially lower than the Chandler. It is very probable that the new product will be marketed largely through the present Chandler distributor organization.

### Inventory of Army Vehicles

WASHINGTON, Feb. 15—The Motor Transport Corps is engaged in taking an inventory of every motor vehicle owned by the army and all equipment, including spare parts, machine shop parts and accessories.

Many motor vehicles had not been taken over formally by the Motor Transport Corps, having been bought and operated by the Ordnance, Quartermaster, Medical, Signal and other branches of the army, and inventories never were made.

### S. A. E. Tractor Dinner Feb. 27

NEW YORK, Feb. 18—A tractor dinner will be held at the Hotel Baltimore, Kansas City, by the Society of Automotive Engineers on Thursday, Feb. 27, during the tractor show. There will be a professional session at the auditorium of the Sweeney Automobile School Thursday afternoon, when a paper on "Tractor Testing" by Prof. J. B. Davidson of the University of California and other papers on tractor engineering will be presented. Dr. Joseph E. Pogue of the U. S. Fuel Administration will discuss the fuel situation as it applies to the tractor industry, and E. R. Hewitt, consulting engineer, International Motors Co., will present a paper on the "Wheeled Farm Tractor."

## Refinery Production for Eleven Months

Stocks of Gasoline and Kerosene Are Relatively Low, but Output Is Maintained

### PRODUCTION

	November, 1918	October, 1918
Crude oil (bbl.).....	27,411,636	29,237,767
Gasoline (gal.).....	312,968,640	314,251,318

### (—Stocks on Hand—)

	Nov. 30, 1918	Oct. 31, 1918
Crude oil (bbl.).....	15,222,401	15,438,756
Oils purchased to be re-run (bbl.) .....	1,373,740	1,308,744
Gasoline (gal.) .....	270,072,011	250,328,329
Kerosene (gal.) .....	397,804,012	419,409,944
Gas and fuel (gal.) .....	583,777,918	596,116,351
Lubricating (gal.) .....	132,923,478	135,196,542
Wax (lb.) .....	190,953,158	195,797,590
Coke (ton) .....	22,005	23,905
Asphaltum (ton) .....	74,955	74,159
Miscellaneous (gal.) .....	466,887,345	457,222,127

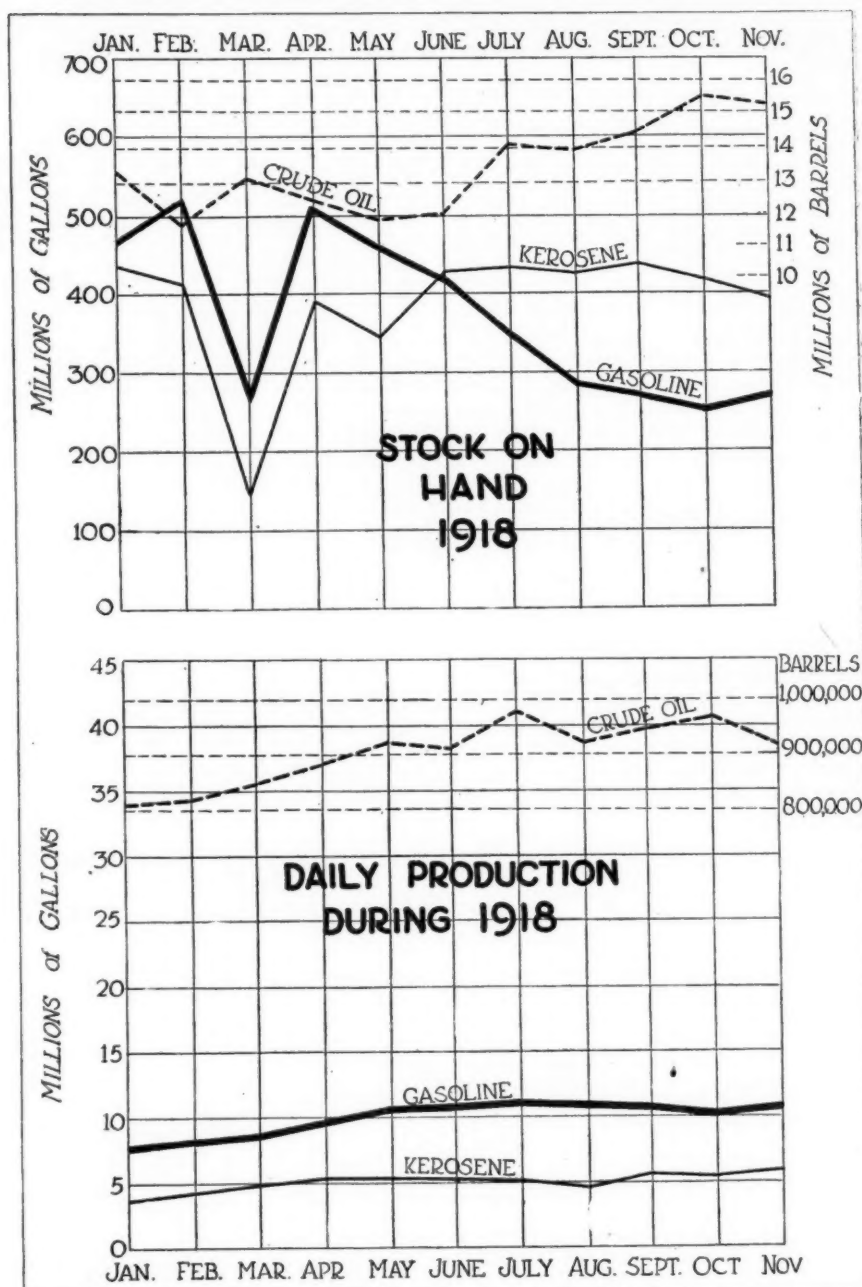
NEW YORK, Feb. 17—It is satisfactory to observe that our average daily production of gasoline, kerosene and crude oil increased steadily month by month from January to November, 1918; our total refinery output for this period also indicates that every effort is being made to produce sufficient petroleum products to keep pace with the ever-increasing demand. On the other hand, our stocks of gasoline and kerosene as of Nov. 30, 1918, are not altogether satisfactory, although in the case of the former we were on that date in a better position than in September and October. Production of crude oil is fully maintained.

At the present time it does not seem likely that our gasoline stocks will show (when figures are available) well in comparison with stocks held in January and February last. The winter has, so far, been abnormally favorable for motoring, and it may be assumed that gasoline consumption has been greater than usual. Against this is the fact that our average daily production of gasoline in January, 1918, was but 7,826,840 gal., as against 10,432,288 gal. per day average in November.

A probable decrease in the quantity of special gasoline for aircraft use may be anticipated, a circumstance which will have its effect on the general supply. During wartime our exports of aircraft gasoline have been very large, and our domestic needs have been extensive.

Our production of gas and fuel oil continues to be maintained. Much of this has been used for war purposes, and although its use in this direction may be curtailed with the coming of peace, there are a great number of oil-burning merchant vessels operating and being built, and doubtless the demand will continue. In a general way, the production of gas and fuel oil means increased production, as every trace of gasoline must be extracted from fuel oil before it is suitable for the purpose for which it is intended.

## Petroleum Products Stock and Production for 1918



These charts show how we stood as regards stock and average daily production of crude oil, gasoline and kerosene during eleven months of 1918

### Stutz Profits Drop

INDIANAPOLIS, Feb. 17—The Stutz Motor Car Co. of America, Inc., for the year ended Dec. 31, 1918, shows net profits of \$594,047 as against \$1,074,778 for 1917, a decrease of \$484,731 for the past year. Gross profits decreased \$462,615, from \$1,107,334 in 1917 to \$644,719 in 1918, and net sales decreased \$946,758, a drop from \$4,483,315 in 1917 to \$3,536,557 in 1918. The complete balance sheet for the past three years follows:

Assets	1918	1917	1916
Plant, equipment, etc.	\$2,675,854	\$2,560,731	\$2,431,603
Cash .....	167,118	252,811	74,059
Accounts Receivable ..	225,435	58,816	145,530
Inventory .....	804,857	1,148,470	577,248
Liberty Bonds .....	50,000	.....	.....
Total .....	\$3,923,264	\$4,015,829	\$3,228,441

### Liabilities

Liabilities	1918	1917	1916
Capital stock .....	\$375,000	\$375,000	\$375,000
Accounts payable .....	358,257	317,462	356,980
Deposits on cars .....	30,500	35,450	17,700
Liberty bonds .....	12,500	.....	.....
Taxes, etc. ....	10,579	6,000	8,500
Reserves .....	87,162	59,491	31,329
Surplus, after payment of Federal taxes, dividends, etc.	3,049,266	3,222,425	2,439,021
Total .....	\$3,923,264	\$4,015,829	\$3,228,441

### Wheat Instead of Hession Tractor

BUFFALO, Feb. 18—The Wheat tractor is the new name for the Hession Tiller & Tractor Corp.'s four-wheel farm and road tractor, formerly known as Hession.

## Post Office Department Has 1200 Army Trucks

WASHINGTON, Feb. 19—The War Department has turned over 1200 army trucks of various types and sizes to the Post Office Department for use in rural mail delivery. Announcement will be made in the near future by the post office of the routes covered by these vehicles. The trucks are turned over by the War Department in compliance with a provision in the Army Appropriation bill of 1918 which ordered all trucks delivered to the Post Office as are requisitioned.

### Nash Pays Extra Dividend

KENOSHA, Feb. 15—In addition to the regular 7 per cent dividend on preferred, Nash Motors Co. has declared a total of \$21 per share on common. An initial dividend of \$6 per share on common was paid Feb. 1, and another common dividend of \$10 per share is payable Feb. 15.

The Nash business for 1918 amounted to \$41,000,000. This represents the production of about 21,000 cars and trucks. It is planned for 1919 to build 25,000 cars and as many trucks as conditions warrant.

### Studebaker Dividends

Studebaker Corp., South Bend, 1 per cent, common; 1½ per cent, preferred; payable March 1 to stockholders of record Feb. 20.

### Hammered Piston Rings Bought by Bartlett Hayward Co.

BALTIMORE, Feb. 14—The Bartlett Hayward Co. has purchased the entire capital stock of the Hammered Piston Ring Co. of America, whose plant is located on South Eleventh Street, Newark. It contemplates keeping the New-

ark plant in operation, but all increases of business will be handled in one of its plants in Baltimore. The active management of the business will remain in charge of C. F. Hockley, vice-president and general manager, who will make headquarters in Newark.

### Ricardo Engine "Made Good" in Tanks (Continued from page 410)

safely be used, thus insuring silent running.

(4) Since the crosshead and guide can be profusely lubricated with clean oil, the wear is reduced to a minimum. Further, both the crosshead sleeve and its guide are small and inexpensive parts, which could in the event of wear be replaced at a very small outlay.

(5) Since the piston itself does not bear upon the cylinder walls, an ample working clearance can be allowed without any risk of noise.

(6) The wear on the cylinder walls is reduced to a minimum, since only the piston rings bear against them and there is no side thrust.

(7) The gudgeon pin being short, stiff and free to rotate, and also being placed in such a position that it receives very little heat from the piston, does not wear perceptibly. The combined wear of the gudgeon pin and bushes after a test run of 450 hours on a large six-cylinder engine at full speed, and an average of nine-tenths full power, was officially reported as being "not measurable" in any of the six pistons.

(8) The heat from the crown of the piston and from the crosshead guide is utilized to warm the air for the carbureter, and is not transferred to the crankcase.

(9) All the working parts can be lubricated without stint and without any risk of excess of oil reaching the cylinder walls; also the oil remains clean.

(10) In the event of any fuel condens-

## Bill Taxing Cars and Trucks Passed by Senate

WASHINGTON, Feb. 14—The new revenue bill, carrying among its provisions a tax of 5 per cent on automobiles and parts, and 3 per cent on trucks and parts, was passed by the Senate yesterday. It now goes to the President for his approval. The bill contains the provisions relative to automotive products just as they were published in AUTOMOTIVE INDUSTRIES last week.

### Ohio Plans to Spend Millions on Roads

COLUMBUS, Feb. 18—The federal government and the state jointly will spend \$15,000,000 annually during the next five years for the improvement of roads through the Buckeye State if a resolution just introduced in the house is adopted and government authorities concur. Congress is requested to appropriate \$1,000,000,000 for good roads, the money to be spent during the next five years.

ing on the walls of the cylinder its subsequent passage into the crankcase can be prevented absolutely.

(11) The restricted lubrication to the cylinder walls prevents any tendency of the piston rings to become carbonized or gummed up. In practice the piston rings always remain clean and perfectly free.

(12) There is no tendency for the engine to become gummed up when cold, and it is in fact almost as free when cold as when hot, and consequently is always very easy to start.

An engine with this piston will be somewhat higher than a conventional engine, somewhat heavier and slightly more expensive to manufacture. The design should recommend itself particularly to engineers aiming at a high fuel economy or those desiring to use heavier grades of fuel, such as kerosene.

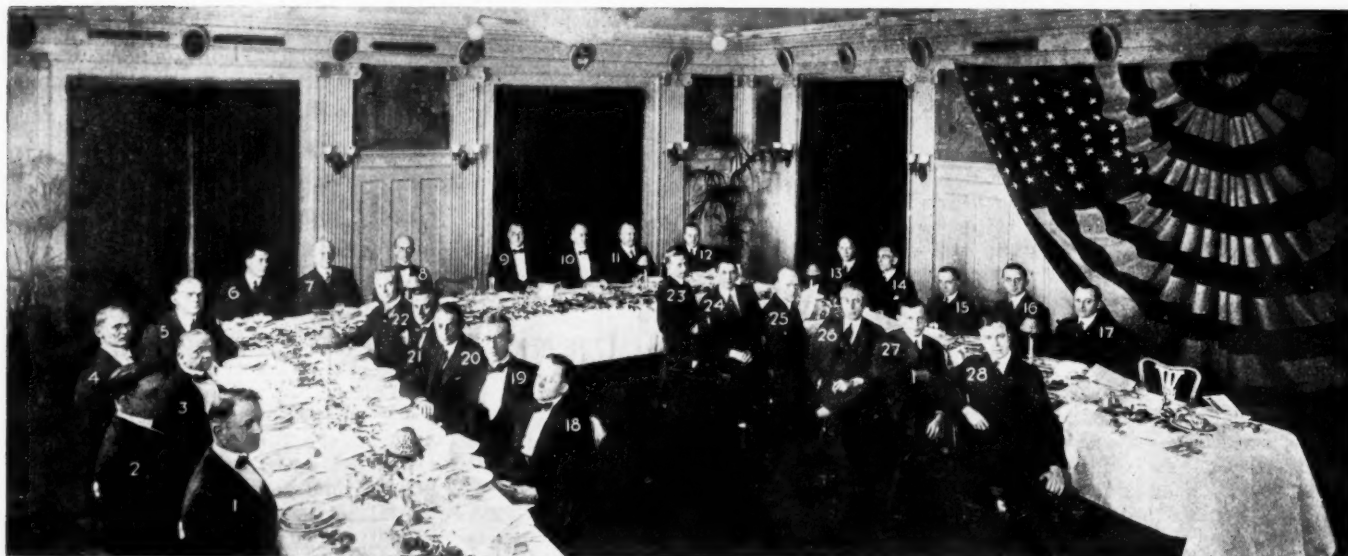
## Total Output of Refineries in the United States for 1917

1917	Crude (bbl.)	Other Oils (bbl.)	Gasoline (gallons)	Kerosene (gallons)	Gas and Fuel (gallons)	Lubricating (gallons)	Wax (pounds)	Coke (tons)	Asphaltum (tons)	Miscellaneous (gallons)	Losses (bbl.)
January	24,839,772		203,618,724	137,248,370	469,596,208	60,941,062	39,558,627	44,627	49,894	27,331,019	941,924
February	23,083,433	no account	184,602,595	129,074,504	446,964,925	54,631,765	36,370,297	42,047	40,619	23,685,686	941,110
March	26,230,133	1st 6 mo.	220,523,571	159,038,978	494,855,838	64,345,221	40,868,930	48,839	52,823	26,977,334	870,380
April	25,994,938	1917	228,945,164	157,826,945	462,846,339	63,218,215	41,037,511	46,099	52,849	30,959,901	957,533
May	27,253,391		238,816,209	147,894,846	504,859,695	65,926,007	38,686,364	43,535	67,612	31,086,377	979,245
June	26,453,210		233,671,746	151,477,333	496,742,434	61,045,757	38,075,280	42,513	67,931	30,205,172	1,011,568
July	26,776,856	2,435,533	244,145,292	161,679,053	599,454,966	64,335,905	40,158,033	42,641	65,272	32,359,401	1,111,511
August	27,900,623	2,376,580	254,464,491	149,528,513	632,151,971	64,107,817	38,999,341	46,240	73,878	32,708,312	1,286,141
September	27,529,022	2,632,988	256,132,050	143,203,644	629,914,572	60,757,049	48,300,033	42,986	62,520	30,386,471	1,182,560
October	27,698,023	2,863,518	271,891,234	140,559,542	621,492,374	68,516,071	41,181,400	48,849	73,886	31,804,160	1,355,219
November	26,215,979	2,519,700	264,888,709	125,893,202	592,490,037	64,861,375	39,694,595	45,815	73,289	37,115,002	1,203,110
Total first											
Eleven months	289,975,385	12,828,319	2,601,699,785	1,603,414,930	5,951,369,359	692,686,244	442,930,411	494,191	680,573	614,618,835	11,840,301
December	25,155,996	2,069,351	248,846,638	123,354,046	561,954,921	61,090,596	38,269,670	45,175	58,852	87,548,408	1,233,528
Total	315,131,681	14,897,670	2,850,546,423	1,726,768,976	6,513,324,280	753,776,840	481,200,081	539,366	739,425	702,167,243	13,073,829

## Total Output of Refineries in the United States for First Eleven Months of 1918

1918	Crude (bbl.)	Other Oils (bbl.)	Gasoline (gallons)	Kerosene (gallons)	Gas and Fuel (gallons)	Lubricating (gallons)	Wax (pounds)	Coke (tons)	Asphaltum (tons)	Miscellaneous (gallons)	Losses (bbl.)
January	23,842,587	2,300,334	242,632,044	119,358,184	547,866,248	56,625,425	39,238,858	41,216	54,854	70,995,829	1,078,181
February	23,386,676	2,298,333	234,324,619	121,218,320	510,165,397	58,300,914	35,087,337	42,371	42,033	75,134,088	983,992
March	26,239,662	3,696,872	269,647,968	151,228,007	587,985,804	69,308,351	43,597,019	44,248	56,901	84,865,148	1,097,439
April	26,201,544	3,956,244	293,396,162	153,703,682	573,255,341	71,022,204	40,173,524	45,674	51,242	89,242,012	1,182,020
May	28,510,698	4,112,023	319,391,202	160,590,760	631,586,209	79,589,755	42,544,633	48,864	60,449	88,627,491	1,269,231
June	28,140,479	3,483,270	315,023,445	151,840,252	628,342,033	84,420,996	41,317,794	46,605	50,321	81,110,922	1,282,177
July	29,170,718	5,951,537	332,022,095	156,828,826	658,439,682	79,303,107	41,691,551	48,914	48,433	155,374,139	1,338,304
August	28,534,275	6,376,353	330,335,046	149,678,850	671,113,871	72,392,879	41,829,516	51,759	59,715	163,355,034	1,337,327
September	28,390,431	5,485,747	314,590,959	164,963,798	653,085,050	70,593,079	42,704,894	48,052	49,157	138,201,963	1,236,834
October	29,237,767	5,571,847	314,251,318	164,928,640	661,780,441	72,244,633	43,470,132	48,820	51,878	166,109,867	1,161,545
November	27,411,636	3,857,754	312,968,640	169,278,105	604,403,494	72,178,602	49,642,007	51,393	35,387	75,430,160	1,236,812
Total	299,066,473	47,090,314	3,278,568,498	1,663,617,424	6,733,523,570	776,477,925	461,297,265	517,916	570,370	1,202,436,653	13,204,064

## Dinner of Automotive Electric Association, Hotel Astor, Feb. 11, 1919



1—E. E. Turner, Assistant Secretary.  
2—G. H. Lewis, Westinghouse Electric & Mfg. Co.  
3—S. L. Nicholson, Westinghouse Electric & Mfg. Co.  
4—E. S. Philips, Philips-Brinton Co.  
5—V. S. Beam, Westinghouse Electric & Mfg. Co.  
6—B. M. Leece, Leece-Neville Co.  
7—J. K. Montgomery, North-East Electric Co.  
8—O. L. Harrison, Dayton Eng. Lab. Co.

9—G. B. Griffin, Westinghouse Electric & Mfg. Co.  
10—J. J. Jackson, Westinghouse Electric & Mfg. Co.  
11—R. W. Sutherland, Splittorf Electric Co.  
12—G. S. Cole, Leece-Neville Co.  
13—A. F. Kurs, Leece-Neville Co.  
14—A. L. Howland, Electric Auto-Lite Corp.  
15—H. C. Branch, Leece-Neville Co.  
16—O. F. Conklin, Remy Elec. Co.  
17—A. H. Timmerman, Wagner Electric Mfg. Co.

18—J. C. McQuiston, Westinghouse Electric & Mfg. Co.  
19—W. A. Chryst, Dayton Eng. Lab. Co.  
20—J. G. Greenleaf, Gray & Davis.  
21—W. B. Moses, Gray & Davis.  
22—W. Gray, Gray & Davis.  
23—J. M. Noble, Prest-O-Lite Co.  
24—J. C. Halbleib, North-East Electric Co.  
25—R. J. Nightingale, Willard Storage Battery Co.  
26—T. R. Cook, Willard Storage Battery Co.  
27—F. F. Dorsey, North-East Electric Co.  
28—O. W. A. Oetting, Willard Storage Battery Co.

**British Guiana a Market for Tractors**

WASHINGTON, Feb. 14—A good market for farm tractors exists in British Guiana, according to a consular report from that country, which states that the use of tractors there has been highly satisfactory. An increased use of automobiles is also apparent, 236 having been imported in 1917 as compared with 147 in 1916.

The country has been exceedingly prosperous. Its leading industries, sugar, rice and balata, have been in great demand. Little difficulty has been experienced in financing trade, although rates of exchange were above normal.

**Truck Show Called Success**

NEW YORK, Feb. 17—From an advertising and prospect-gathering point of view, the exclusive commercial vehicle show staged as part two of the two-week exhibition put on in Madison Square Garden and the Sixty-ninth Regiment Armory by the New York dealers can be written down as a success. And, although the dealers did not expect to close very much actual business at the show, exhibitors report that sales have been up to expectations.

The advertising value of the show has been great, and, in the opinion of dealers, great advertising is necessary. They will have to sell this year as many trucks as were produced in the years 1916 and 1915 combined. The feeling at present is optimistic. Businesses are expanding and everywhere the call for transportation is insistent. And a big part of the success of the show will come from placing before business multitudes of sizes and

varieties of individual and special transportation represented by the motor truck.

Attendance is said to have been satisfactory. At no time were the two halls over-crowded, but it was a business crowd that passed the ticket takers.

Those who exhibited tractors proclaim themselves more than satisfied with results. One firm closed wholesale territory for Maine, Vermont, Massachusetts, Connecticut and the British West Indies. Another filled a book with prospects' names and expects to close a good percentage of them.

**Exports Control Committee to Dissolve**

WASHINGTON, Feb. 14—Dissolution of the Exports Control Committee as early as March 1 is suggested by the chairman of that committee in a letter addressed to Secretary of War Newton D. Baker and Secretary of the Navy Daniels. This committee had control of export shipments during the war by routing, allocation and other necessary restrictions. Its plan to dissolve in the near future forecasts a complete return to normal shipping conditions.

**May Ship Tires Without Special License**

WASHINGTON, Feb. 14—In shipping automobiles to Denmark, Norway, Sweden and Holland, it will no longer be necessary, according to the War Trade Board, to furnish with the application for export licenses an import certificate number covering the tires on the automobile. The import certificate for an automobile, and an export license issued therefor, will include the necessary tires.

**Australia-London Air Route Planned**

WASHINGTON, Feb. 18—An aerial service is planned between Australia and London by private Australian business men who have formed a company under Reginald Lloyd of London with a paid-up capital of \$48,665.

The purpose of the company is to explore the proposed route for landing sites, to be approximately 300 miles apart. The route is to be from Sydney or Melbourne direct to Port Darwin, in the northern territory of Australia, from which point there will be a 300-mile sea trip across to the Island of Timor in the Dutch East Indies, thence from island to island through Java and Sumatra to Singapore and Calcutta, across India to Karachi, thence to Bagdad and Port Said, from which latter point the choice of several developed aerial routes to London are available.

Next month Mr. Lloyd will lead a surveying party from Australia through the Dutch East Indies, the Malay States, India and Mesopotamia, to locate landing sites and to arrange for their lease or purchase. The organization of the present company is merely to provide for the expenses of this routing party. After the completion of this survey it is proposed to finance a company in London to operate the aerial service to Australia.

**Value of War Vehicles**

WASHINGTON, Feb. 15—According to a report made public to-day by the War Department, there were motor vehicles valued at \$69,567,173 on hand on Nov. 1, 1918, and \$79,908,070 on Jan. 1, 1919.

## Air Medical Tests for Flyers

**But 61 Per Cent Qualify for All Duties—Trained to Flying Experiences on Ground**

WASHINGTON, Feb. 18—Of each 100 flyers accepted by the medical service of the Aviation Corps, 61 are capable of flying in altitudes over 28,000 ft., 25 are capable of flying in altitudes up to 15,000 ft. and 14 are capable of flying at 8000 ft. or less. Consequently, 61 are fitted for any air work, 25 may perform such work as bombing and 14 are limited to night bombing. These figures are the results of numerous tests made by the Air Medical Service, following the acceptance of candidates for flying duties.

The tests for altitude are made on the ground by means of a device called the "Flack-bag," which reduces the oxygen the aviator breathes so that within 25 minutes there is but 8 per cent of oxygen in the tank, creating an atmosphere equal to 28,000 ft. The weaker flyers taking this test quickly react to the limited supply of oxygen.

Other tests are also made for vision and balancing, both of which are affected by altitude. Low oxygen effects the vision. The tests given are also used to determine which men have better "night sight" for night bombing work.

Performance of stunts and low oxygen affect the internal ear, and cause the flier to lose his balance. Consequently, examinations were made of the internal ear to determine whether or not flyers are capable of withstanding low oxygen and whether they are able to perform stunts without losing their sense of balance.

All flyers are frequently examined by a re-breathing test, as it has been found that in many instances men who are capable of standing 25,000 ft. altitude at one time, are not equal to it at other periods.

In making the tests for examination of stunting ability, flyers are placed in a machine called the "Ruggles Orientator." This machine allows the cadet to acquire flying experience without leaving the ground.

It is a modification of the old-fashioned universal joint, composed of three concentric rings so pivoted together as to permit the fuselage, which is pivoted within the innermost ring through every possible evolution to be experienced in actual flying. It is practically an airplane in every respect. The cadet sits in the fuselage and by means of control stick and rudder puts himself through all the evolutions he is later to experience in the air. These evolutions stimulate the internal ear, which send the nerve impulses to the brain. Consequently, after flying day after day in this apparatus the cadet is entirely familiar with the sensations he will experience in an air flight. He is thus prepared to realize and cope with the peculiar conditions incidental to aviation.

The Air Medical Service divides its system of operation in three ways: Selection, classification and maintenance. Tests for selection are standardized. Examiners making the tests are also standardized.

A late innovation in the Air Medical Service includes what is known as the Flight Surgeon, who examines intimately the conditions in aviation accidents, and makes recommendations accordingly. For example: He finds that the cowl of an airplane provides too little play for the head, and that flyers cut their heads in crashes as a result. He recommends more room. Such recommendations have been shown to result in 10 to 30 per cent less accidents. Another recommendation instituted the use of a rubber shock absorber, used to attach the safety belt to the machine. This lessened the number of broken ribs.

## Dealers Hold Tractor Agencies

**No Thought of Giving Up Truck or Tractor Agencies—Minneapolis Show Huge Success**

MINNEAPOLIS, Feb. 19—The rumors that dealers will give up truck and tractor agencies and handle passenger cars only in these post-war days are entirely unfounded as far as this section is concerned. Interviews with many dealers at the 1919 Northwestern Automotive and Industrial Exposition here shows them very enthusiastic over the passenger car outlook, but in no way inclined to give up truck or tractor business.

The show is a huge success. Attendance records are far in excess of all previous years. Good crops and high prices for them have resulted in a good prosperity. Farmers and dealers are here from the entire territory solely for the show.

## Highway Committee's Report to Annual Convention

NEW YORK, Feb. 20—The National Highway Committee of the American Road Builders' Association has prepared an interesting report on the problem of adequate roads for presentation at the ninth annual convention. This convention will be held at the Hotel McAlpin, Feb. 25-28.

In this report reference is made to the new era of highway transportation and the necessity of providing adequately for the traffic, maintaining the road systems and connecting the interior with the seaboard in such a way as to obtain maximum results. The benefits to be derived from the establishment of a national highway system, built and maintained by the Federal Government, are also dealt with in detail. The matter of military benefit resulting from such a system is also considered. It is expected that this report will be presented at the Feb. 27th session of the convention.

## Labor Standards of England Changed

**Shorter Working Hours More Productive—Workers Use Spare Time Profitably**

LONDON, Feb. 1—The majority of factories in Great Britain went on a 47-hr. week schedule on Jan. 1, as compared with 52- and 56-hr. formerly. During the war many of the companies worked from 6 a. m. until 6.30 p. m. There has been a good deal of opposition on the part of many British manufacturers to the 47-hr. week on the ground that the laborer would scarcely know what to do with his extra time. There was a general feeling that he would spend his time and money at the saloon, so the shorter working hour would be an evil rather than a benefit.

The case of the Ford Co. at Manchester rather disproves this. The company, formerly working on a 48-hr. week schedule, dropped to 40-hr. On this shorter schedule, which was started Jan. 1, the 1500 employees are assembling two to three chassis per day more than on the longer schedule. This is largely due to a better spirit of co-operation among the workers, the majority of whom realize the benefit of shorter hours. An investigation showed that instead of these workers spending their time at the saloon they were taking up such pastime as chicken raising and gardening. Many of the garden spaces doubled as soon as the extra spare time was allowed, and there was a great demand for lumber for building chicken coops which indicated a healthy disposition on the part of the worker. There was no increase in drunkenness. In fact, the contrary prevailed.

British manufacturers have already realized that production was very low in the early morning hours, particularly from 6 until 9 a. m., when many of the employees returned home for breakfast. There has been a good deal of opposition to starting work at 8 on the ground that it calls for an earlier breakfast than the Britisher has been accustomed to, but already the benefit of such a move is being realized, and opposition from the housewife is passing.

France is beginning to realize that the heavy noonday meal is a manufacturing error, and some factories where 1½ to 2 hours are taken off at noon so that the workers might go home for the heaviest meal of the day realize that they are losing two of the best hours of sunshine, and that after the workers return it is an hour or perhaps longer before they are back on an efficiency basis, because of the heavy meal eaten. The ½-hour luncheon is desired by the more progressive French makers, but they realize the difficulty ahead in overcoming the tradition of the French home in regard to the noonday meal.

The automobile industry in England is bound to suffer more because of the labor upheaval than it would have previ-

ous to the war. Such places as Coventry, for example, have increased their population more during the war than at any time previously, and have become trade centers as well as labor centers, and so the automobile industry has come more under labor problems than ever before.

The present working-out of the short week seems to draw attention to two factors: First, the upsetting of domestic arrangements that have been traditional; and, second, the curtailing of minor privileges which the individual has for years enjoyed. The upsetting of home routine by the earlier breakfast and the shorter meal hour has been referred to.

The curtailing of individual privileges has more to do with the factory. The tea hour or half-hour is being eliminated. The rule against smoking must be enforced, and with the shorter week it will be necessary for the worker to work at higher efficiency than ever before. Some of the factories have reduced the working temperature so as to stimulate activity. Others have insisted on medical examinations and hospital service so as to increase the usefulness of the worker. For a time the worker is going to object to many of these innovations on the ground that it is interfering with his individuality and the employer has a problem on his hands to convince him that it is for his benefit as well as the factory.

#### Contract Bill Again Held Up

WASHINGTON, Feb. 19—The bill providing for the payment of informal contracts which was passed by the Senate and reported to the House for approval by the Conference Committee was ordered back to the Committee by the House yesterday for the elimination of certain amendments. Only very prompt action by Congress can now secure the passage of the bill during the present session.

#### Michigan Copper & Brass Profits \$186,507

DETROIT, Feb. 17—The balance sheet of the Michigan Copper & Brass Co. for 1918 shows net profits totaling \$186,507.88 on outstanding capital stock of \$991,350. After reserving \$20,000 for federal taxes and paying dividends of \$29,740 at 4 per cent, the company's total surplus at the beginning of the year stood at \$1,570,776.91. It shows a property account on Dec. 31, 1918, of \$1,407,407, of which \$276,791 is in a new rod mill constructed during the war. Current assets are placed at \$3,124,137 and total assets \$5,033,028. Current liabilities are \$2,470,901. D. M. Ireland is president and Alonzo Ewing, vice-president and general manager.

#### Christian Girl Back at His Desk

CLEVELAND, Feb. 19—Christian Girl, president of the Standard Parts Co., who has been South recuperating from a slight operation this fall, is again in good health, and will resume his business duties in April.

## Ocean Flight Topic at Aero Dinner

### Two Entries for Atlantic Flight Already In—Dinner Attended by 800 Fliers—Dirigibles Approved for Commerce

NEW YORK CITY, Feb. 19—That two entries have been registered for the transatlantic flight with the Royal Aero Club of Great Britain was announced at the thirteenth annual banquet of the Aero Club of America, held in this city tonight, and attended by upward of 800 aviation enthusiasts.

So far no other specific entries seem to have been received for the trans-ocean flight.

Capt. Edward Rickenbacker recommended that some form of memorial be erected in the cemetery at Toul, France, where many of our American aviators are buried. He also suggested that some form of memorial be erected at a suitable place in America to the memory of these aviators.

It was the general belief of practically all of the aviators present that the Atlantic would be crossed this year. The value of the dirigible as a vehicle for long distance transportation was favorably commented upon. Over a dozen American Aces, recently returned from the front, were guests at the dinner.

General Menoher, new chief of the air service, spoke favorably on commercial aviation, as follows:

"I look to see in the near future, in a matter of months only, perhaps, the command of the line of battle exercised from the air instead of from some dugout out of sight and more or less out of touch with the situation."

"As in the case of any commercial activity, there should be constant endeavor toward standardization. To adequately accomplish this there should be:

"A—A national aircraft engineering standards commission working in conjunction with our Bureau of Standards, which commission should be in touch with a similar international standards commission.

"B—A national aerial digest bureau, charged with the collection and publication of data which mark new advances in the development and use of aircraft and aircraft material, and the results of physical and medical research pertaining thereto.

"C—The publication of a revised, up-to-date aeronautical dictionary.

"D—The formation of aero clubs, either branches of or affiliated with a central national association, which should have a directorship consisting of representatives from the army, navy, postoffice, weather bureau, Smithsonian Institution, National Advisory Committee of Aeronautics, Aero Club of America, American Society of Aeronautical Engineers, Manufacturers' Aircraft Association, intercollegiate representation, etc."

#### - Brazil Reduces Duty on U. S. Tires

WASHINGTON, Jan. 27—The Congress of Brazil has adopted the usual authorization for an executive decree to continue the preferential tariff treatment

of some American products during 1919. The articles on which the reduction is granted will be specified in a separate decree, and will probably be similar to the list of 1918, when a reduction of 20 per cent was allowed in the duties on rubber tires, among other commodities.

#### 38,052 Government Vehicles to Be Delivered

WASHINGTON, Feb. 15—On Jan. 9, practically two months after the signing of the armistice, there were on order and still undelivered to the Government a total of 38,052 automotive vehicles as follows:

G. M. C. 1-ton ambulances.....	1,834
G. M. C. standard 1-ton trucks.....	4,921
1½-ton standard trucks.....	3,090
Standard 3-, 4- and 5-ton trucks.....	9,068
Special 2- and 3-ton trucks.....	7,782
Limousines .....	15
Motorcycles .....	9,408
Standard 1½-ton trucks for domestic use .....	563
Standard 3-ton and heavier trucks for domestic use .....	1,371
	<hr/> 38,052

At the time of the signing of the armistice there were on order and still undelivered to the Government 138,424 automobiles and trucks; 96,952 of this number was canceled, and the balance, 41,472, was to be delivered at a future date.

#### Outlook Windshields to Be Exhibited at Lyons Fair

CLEVELAND, Feb. 19—Outlook windshields, made by the Outlook Co. of this city, will be exhibited at the forthcoming Lyons Fair (France) by Dutrieu & Co., Paris, distributors of the line.

#### Mechanical Engineers to Hold Meeting

NEW YORK, Feb. 20—Afternoon and evening meetings of the American Society of Mechanical Engineers are scheduled for Feb. 24. Subjects to be discussed are the application of electrical control to gate valves and the application to industry of the personnel work of the U. S. Army. Motion pictures and lantern slides will be shown and proceedings terminate with a buffet supper.

#### Fisk Reduces Common to \$25 a Share

CHICOPEE FALLS, MASS., Feb. 19—At the annual meeting of the Fisk Rubber Co. to-day stockholders voted to change the par value of the common stock from \$100 to \$25 a share. They also authorized the reduction of the capital stock by \$770,100 through the retirement of 7,701 shares of first preferred stock now held in the treasury. This stock was purchased by the company. All officers and directors were re-elected.

According to the company's financial statement for the year ended Dec. 31 last, net sales for 1918 amounted to \$36,682,163. The total surplus for the year was \$4,425,923, approximately \$400,000 more than 1917. After deducting costs, interest on borrowed money, etc., a net surplus of \$3,760,279 remained.

## Mexican Bank Law Secures Credit

### Bill to Develop National Banks — To Eliminate Present Foreign Cash Basis

WASHINGTON, Feb. 18—Exporters of automotive products to Mexico will benefit by the new banking system in that country planned by President Carranza in a law recently submitted to the Mexican Congress. The bill provides for development of national banks, broadening the Mexican banking system and completely revising the banking law of 1897. If passed, the bill will undoubtedly eliminate the present strictly cash basis with American manufacturers now insisted upon in their Mexican export business. The bill is particularly designed to establish a sole bank of emission and other banks for the development of specific industries, to stabilize the unsettled money market resulting from the European war, establish credits on a fair basis and promote loans at a reasonable rate of interest.

#### Has Few National Banks

Mexico, during the past few years, since the fall of President Diaz, has practically been without national banking institutions and has been dependent on private banking organizations whose activities are limited almost entirely to the issuance, purchase and sale of foreign exchange, and a few commercial credit transactions. As a result, commercial credits and advances on bills of lading have been made only at exorbitant rates. Finances for import shipments have been difficult to secure. Consequently, both the exporters into Mexico and the Mexican importers have had difficulty in stabilizing their business in that country and commerce has suffered. In fact, at present American trade with Mexico has been on a cash basis with but few exceptions. American commission merchants and manufacturers' agents have had to insist on partial cash payment of the invoice value of import orders with the balance usually covered by sight drafts and documents payable at New York or the Mexican port of entry.

The Mexican Department of Finance, however, has determined to assist Mexican business men, and it is certain that under the new law the bulk of Mexican import trade will be done in the future on a credit basis. Our proximity gives us a certain advantage in competition with European manufacturers, but the latter are preparing to enter the field and extend credit, while American makers, according to the Department of Commerce, are still trying to maintain a cash basis.

Under the proposed law the following classifications of banking institutions of credit are made:

Sole bank of emission.  
Mortgage banks to make loans secured by urban or rural real estate.

Banks of promotion to facilitate or encourage mining, industrial and commercial operations.

Agricultural banks to make loans for the purchase of equipment or expense of operation, to be secured by the products and crops of the farm.

Petroleum banks to make loans for equipment and operation to petroleum exploitation enterprises.

The purpose of this classification is to promote more efficient response to the needs of the different lines of production and so guarantee ready capital for the promotion of industry, commerce and agriculture. Under the new law, a minimum capitalization is specified of at least \$250,000 in the case of agricultural banks, banks of deposits and banks of promotion, and \$500,000 with the mortgage and petroleum banks to be contributed at once.

#### Dirigibles for Commercial Flights

(Continued from page 437)

wireless system extending over the complete area covered by the planes.

AUTOMOTIVE INDUSTRIES is one of the most enthusiastic supporters of commercial aviation, but it does not want to see the art given a body blow while in its swaddling garments, due to the over-enthusiasm of some stock promoter who is looking only toward his pocketbook, and not toward the future of this field of transportation. The exploitation of commercial aviation by a few such promoters would do an injury that could scarcely be overcome in 10 years.

These are days when the Government should be carrying on many of the activities which are fundamentals in successful aerial transportation. These fundamentals must be started long in advance of the time when planes are ready to do the work. If we had a complete, thoroughly worked out system of landing fields, wireless, signals, meteorology, aerial navigation, etc., it would be possible with present planes to carry on successful systems of mail and express handling. Without these no system can be successful. The vehicle is now as a vehicle of transportation very far in advance of the necessary systems which are needed in conjunction with it. By the time adequate measures are completed for carrying on aerial navigation, commercial types of planes will be developed on a par if not far beyond that of the system for control.

#### Dirigible Logical for Distance Flights

In aerial transportation over any country such as the United States there must also be carefully weighed the relative field for the airplane and the dirigible. For long distance passenger travel between New York and Chicago, the dirigible to-day seems the logical machine. With it, it would be possible to carry 300 persons with baggage, between these cities on a night journey. The trip could be made with complete safety. On the other hand, such a trip with airplanes would be accompanied with great danger until all of the necessities mentioned surrounding commercial aviation have been accomplished. Even then the safety

## Canada Importer of Tractor Engines

### Takes 60 Per Cent of Exports —New Zealand and France Next

WASHINGTON, Feb. 17—Exports of gasoline and steam tractor engines during December, 1918, totalled 1816, of which 1734 were gasoline and 82 steam. Shipments to Canada were in excess of 60 per cent of the total number exported, that country taking 1181 gasoline and all of the steam tractor engines.

The average prices paid by the different nations vary considerably, with \$1,125 per engine by England, \$713 by Canada, \$700 by France and but \$418 by New Zealand.

Following is the list of tractor engines exported in December:

Countries	Gasoline		Steam	
	No.	Dollars	No.	Dollars
Denmark .....	2	6,800	..	..
France .....	131	91,704	..	..
Italy .....	45	91,550	..	..
Spain .....	6	7,762	..	..
England .....	129	145,149	..	..
Canada .....	1,181	842,411	82	167,556
Mexico .....	17	20,070	..	..
Jamaica .....	6	5,249	..	..
Trinidad .....	2	1,780	..	..
Cuba .....	4	8,465	..	..
Argentina .....	3	6,005	..	..
Bolivia .....	2	3,100	..	..
Peru .....	43	48,066	..	..
Dutch East Indies	1	4,200	..	..
Japan .....	1	4,500	..	..
New Zealand .....	148	61,927	..	..
Philippine Islands	6	1,350	..	..
French Africa ..	7	5,250	..	..
Total .....	1,734	1,355,338	82	167,556

factor with a dirigible is amazingly more attractive than that of the airplane, unless there is developed some other means of increasing the safety element.

The development of airplane pilots for commercial use is a work that must be done at once. The majority of our pilots who fought in the war have no thought of entering commercial aviation. Many of them are college men to whom the role of an aerial chauffeur has no attractions. Some of them have expressed themselves as fortunate if they never have to ride in an airplane again, but if war broke out they would volunteer at once.

With these men there is a great difference between war and commercial aviation. It will be necessary to develop commercial pilots, the same as we have engineers for our passenger and freight trains, drivers for our motor trucks and chauffeurs for our automobiles. These pilots will do the job for the weekly wage rather than for any aerial thrills. The work must be brought on to a sound business basis.

The stunt in all its forms will be eliminated, and the only requirement will be that the aerial vehicle, in whatever form it may be, will start on schedule, make its trip on schedule, arrive at its destination on schedule, irrespective of wind, rain, fog, or snow. Only when this is accomplished will aerial commercial navigation be a success.

## AUTOMOTIVE MATERIALS MARKETS

## Materials Market Prices

## Acids:

Muriatic, lb. ....	.02	-.03
Phosphoric (85%)..	.35	-.39
Sulphuric (60%), lb.	.008	

## Aluminum:

Ingot, lb. ....	.30	-.33
Sheets (18 gage or more), lb. ....	.42	
Antimony, lb. ....	.07 1/4	-.07 1/2

## Burlap:

8 oz., yd. ....	.10 1/2	
10 1/2 oz., yd. ....	.16 1/2	

## Copper:

Elec., lb. ....	.17	-.17 1/2
Lake, lb. ....	.19	-.19 1/2

## Fabric, Tire (17 1/4 oz.):

Sea Is., combed, sq. yd.	1.50	
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Egypt, combed, sq. yd.	1.25	
Egypt, carded, sq. yd.	1.15	
Peelers, combed, sq. yd.	1.10	
Peelers, carded, sq. yd.	1.00	

## Fibre (1/4 in. sheet base), lb. ....

Ceylon, lb. ....	.09	-.22
Madagascar, lb. ..	.10	-.15
Mexico, lb. ....	.03 3/4	

## Lead, lb. ....

4474-.0525		
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## Leather:

Hides, lb. ....	.18	-.34 1/2
Nickel, lb. ....	.40	

## Oil:

Gasoline:		
Auto, gal. ....	.24 1/2	
68 to 70 gal. ....	.30 1/2	
Lard:		
Prime City, gal. ....	1.90-2.00	
Ex. No. 1, gal. ....	1.10	
Linseed, gal. ....	1.45-1.48	
Petroleum (crude):		
Kansas, bbl. ....	2.25	
Pennsylv. a. bbl. ....	4.00	
Manhaden (dark), gal. ....	1.05-1.06	

## Rubber:

Ceylon:		
First latex pale crepe, lb. ....	.56	
Brown crepe, thin, clear, lb. ....	.49	
Smoked, ribbed sheets, lb. ....	.56	
Para:		
Up River, fine, lb. ....	.58 1/2	-.59
Up River, coarse, lb. ....	.35	

## Island, fine, lb. ....

Shellac (orange), lb.	.64	
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## Speiter ....

.06 1/2	-.06 3/4	
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## Steel:

Angle beams and channels, lb. ....	.03	
Automobile sheet (see sp. table.)		
Cold rolled, lb. ....	.0625	
Hot rolled, lb. ....	.039	

## Tin ....

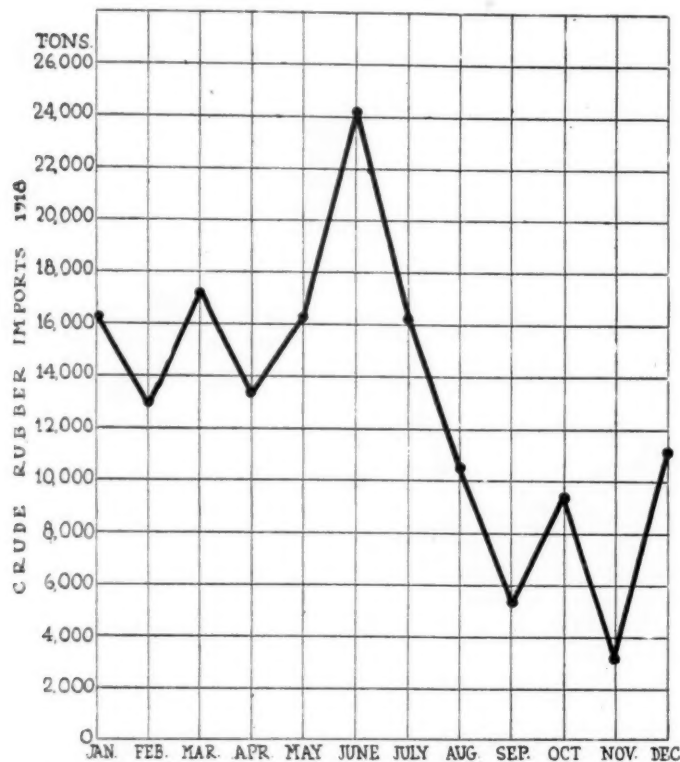
.71	-.72	
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## Tungsten, lb. ....

1.50-2.10		
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## Waste (cotton), lb. ....

.12 3/4	-.17	
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Fluctuations in our monthly imports of crude rubber during 1918 were caused to some extent by Government restrictions and quantity limitations

## AUTOMOBILE SHEET PRICES

(Based on No. 22 Gage. Other gages at usual differentials)

	Primes only per 100 lbs.	Primes when seconds up to 15 per cent are taken per 100 lbs.
Automobile body stock, .....	\$5.95	\$5.85
Automobile body stock, deep stamping, .....	6.20	6.10
Automobile body stock, extra deep stamping, .....	6.45	6.35
Hood, flat, fender, door and apron, or splash guard stock, .....	6.05	5.95
Crown fender, cowl and radiator casing, extra deep stamping, .....	6.55	6.45
Crown fender, cowl and radiator casing, deep stamping, .....	6.30	6.20
Automobile Sheet Extras for Extreme Widths:		
Nos. 17 and 18 over 36 in. to 44 in., 10c. per 100 lb.		
Nos. 19 and 21 over 36 in. to 44 in., 30c. per 100 lb.		
Nos. 22 to 24 over 26 in. to 40 in., 40c. per 100 lb.		
Nos. 22 to 24 over 40 in. to 44 in., 80c. per 100 lb.		
Blank Sheet Extras to Apply to Narrow Widths:		
Oiling, 10c. per 100 lb.		
Patent leveling, 25c. per 100 lb.		
Resquaring, 5 per cent of gage price after quality, finish and size extras have been added.		
* Seconds 10 per cent less than the invoice Pittsburgh price for corresponding primes.		

## Automotive Securities on the Chicago Exchange at Close Feb. 15

	Bid	Asked	Net Ch'ge		Bid	Asked	Net Ch'ge		Bid	Asked	Net Ch'ge
Auto Body Company .....	6 1/2	8 1/2	..	Motor Products Corp. ....	40	..	..	RUBBER STOCKS			
Briscoe Motor Car com. ....	10	..	..	Nash Motors Co. com. ....	175	200	+5	Ajax Rubber Co. ....	71 1/2	73	+1 1/2
Briscoe Motor Car pfd. ....	35	50	..	Nash Motors Co. pfd. ....	93	97	..	Firestone T. & R. com. ....	140	145	..
Chandler Motor Car. ....	114	116	+1 1/2	National Motor Co. ....	6	10	..	Firestone T. & R. pfd. ....	95 1/2	100	..
Chevrolet Motor Car. ....	164	166	+10	Packard Motor Car com. ....	112	120	-4	Fisk Rubber Co. com. ....	87	89	..
Cole Motor Car Co. ....	90	105	..	Packard Motor Car pfd. ....	99	103	..	Fisk Rubber 1st pfd. ....	102	105	+5
*Continental Motors com. ....	7 1/2	8	..	Paige-Detroit Motor com. ....	24 1/2	25 1/2	..	Fisk Rubber 2d pfd. ....	97	100	+12
Continental Motors pfd. ....	96	..	+1	Paige-Detroit Motor pfd. ....	8 3/4	9 3/4	..	Fisk Rubber 1st pfd conv. 99	99	101	..
Edmunds & Jones com. ....	15	20	..	Peerless Motor Truck. ....	18	21	..	Goodrich, B. F. com. ....	59 1/4	60	-1 3/4
Edmunds & Jones pfd. ....	75	90	..	Pierce-Arrow M. Car com. ....	39 3/4	40 3/4	+ 3/4	Goodrich, B. F. pfd. ....	104 3/4	105	+1 3/4
Electric Storage Bat. ....	54	58	+4	Pierce-Arrow M. Car pfd. ....	102	..	..	Goodyear T. & R. com. ....	245	249	+5
Federal Motor Truck. ....	30	34	..	Premier Motor Corp. com. ....	5	..	..	Goodyear T. & R. 1st pfd. ....	103 1/2	105	..
Fisher Body Co. com. ....	40 1/4	42	-2 1/4	Premier Motor Corp. pfd. ....	..	75	..	Goodyear T. & R. 2d pfd. ....	103 1/2	105	..
Fisher Body Co. pfd. ....	90	93 3/4	..	Prudden Wheel Company. ....	15 3/4	16 1/2	+ 3/4	Kelly-Springfield com. ....	82 3/4	83	+5 3/4
Ford Motor of Canada. ....	264	268	-1	Reo Motor Car Co. ....	21 1/2	22 1/2	..	Kelly-Springfield 1st pfd. ....	93	98	+2
General Motors com. ....	130	131	- 1/2	*Republic M. Truck com. ....	35 1/2	37 1/2	..	Lee Tire & Rubber Co. ....	23 3/4	24	+ 3/4
General Motors pfd. ....	82 3/4	84 3/4	-1 1/4	Republic M. Truck pfd. ....	87	90	..	Marathon Tire & Rubber. ....	55	70	..
Hupp Motor Car com. ....	6	6 3/4	- 1/4	Saxon Motor Car com. ....	8 1/4	10 1/4	+ 3/4	Miller Rubber Co. com. ....	178	180	+18
Hupp Motor Car pfd. ....	90	..	..	Scripps-Booth Corp. ....	21	25	..	Miller Rubber Co. pfd. ....	102	103	+6
Kelsey Wheel Co. com. ....	20	36	-8	*Stewart Warner Spd. Corp. ....	83	85	- 3/4	Rubber Products Co. ....	117	121	+3
Kelsey Wheel Co. pfd. ....	91	95	+3	Stromberg Carburetor Co. ....	40	43	..	Portage Rubber Co., com. ....	162	165	+7
Manhattan Electric S. com. ....	..	48	..	Studebaker Corp. com. ....	52 1/2	53 1/2	+2	Swinehart T. & R. Co. ....	95	100	+45
Maxwell Motor com. ....	31 3/4	32 3/4	+1	Studebaker Corp. pfd. ....	92	95	..	U. S. Rubber Co. com. ....	75 1/4	75 3/4	- 3/4
Maxwell Motor 1st pfd. ....	54 1/2	55 1/2	+1	Stutz Motor Car Co. ....	42 1/2	43 1/2	+ 1/4	*U. S. Rubber Co., pfd. ....	109 1/4	110	..
Maxwell Motor 2d pfd. ....	21 1/2	22 1/2	..	United Motors Corp. ....	38 1/2	40 1/2	- 1/2				
McCord Mfg. com. ....	32	35	..	White Motor Co. ....	49 1/2	50 1/2	+2 1/2				
McCord Mfg. pfd. ....	93	96	..	*Willys-Overland com. ....	24 3/4	25 3/4	+ 1/2				
Mitchell Motor Co. ....	24	30	..	Willys-Overland pfd. ....	88	88 1/2	..				

\*Ex Dividend.

**Dedell Heads Firestone Advertising**

AKRON, Feb. 17—J. R. Dedell, until recently connected with the Corday & Gross Advertising Co., Cleveland, has been appointed advertising manager of the Firestone Tire & Rubber Co., Akron.

Capt. Carl V. Richardson has opened an office at 1305 Monadnock Block, Chicago. He will specialize on consultations and designs of internal combustion engines, tractors and trucks. Previous to army service, he was experimental engineer with the Parrett Tractor Co. and designing engineer with the Buda Co.

A. A. Gloetzner has been elected vice-president of the Covert Gear Co., Inc., Detroit. He will also retain his present duties as chief engineer and manager of sales.

Fred B. Sides has been appointed assistant sales manager of the Hupp Motor Car Corp. He joined this company in 1915 as office manager.

E. J. Quirk, who has been in government service, has returned to the retail sales department of the Detroit office of the Studebaker Corp.

Lewis G. Harris has been appointed sales manager of the West Detroit Auto Sales Co., to succeed J. L. Cough, who has resigned.

William H. Little has resumed his duties as general manager of the Scripps-Booth Corp. During the war he was supervisor of engine production for the army in the Chicago district.

A. H. Schiappacasse, for six years connected with the engineering and service departments of Dodge Brothers, has resigned to become assistant manager and research engineer of the Brisk-Blast Co., Monroe.

F. J. Fisher has been released from the Motor Transport Corps and has resumed his duties as secretary and treasurer of the Standard Motor Truck Co., Detroit.

Birkett L. Williams has been appointed sales manager of the truck department of the Grant Motor Car Corp., Cleveland.

**Goodrich Vice-President Back From Service**

AKRON, Feb. 15—Lt. Col. A. B. Jones, vice-president of the B. F. Goodrich Rubber Co., who has just returned home, left here in August to take charge of the motor transport work of the Red Cross in France, when it formed its own department to handle its supplies. In October, Colonel Jones succeeded Colonel Harvey Gibson as commissioner for France, when Colonel Gibson was made chairman of the commission for Europe.

**Men  
of the Industry****Changes in Personnel and  
Position****Jacobsson Sails for Scandinavia**

NEW YORK, Feb. 17—Birger Jacobsson, representing the J. B. Crockett Co., Inc., exporters, sails this week for Scandinavia on a business trip.

Capt. E. A. Callanan has been appointed general purchasing agent for the Cleveland Tractor Co., Cleveland. For the past 15 months he has been in charge of the production of the De Havilland battle planes at the Dayton-Wright plant, Dayton. Previous to that he was for five years assistant purchasing agent for the Willys-Overland Co., Toledo, and was later a manager in the branch department of that organization.

Arthur C. Brackle, president Olympian Car Co., Milwaukee, distributor of the Olympian in Wisconsin and upper Michigan, was elected a director of the manufacturing corporation at the annual meeting held in Pontiac on Feb. 14.

George C. Baldwin, formerly with the Saxon Motor Car Corp., has been appointed field manager for the United Motors Service, Inc. This position includes the distribution of technical information and records, advertising and supervision of all branches and authorized distributors. Besides his connection with the Saxon corporation, Mr. Baldwin has been service manager for the Cadillac Motor Car Co. and the Studebaker Corp.

J. L. Hardig, formerly advertising manager of the Remy Electric Co., has been appointed assistant advertising manager of the Motor Equipment Division of the United Motors Corp., Detroit.

A. E. Maltby has resigned as branch manager of the Winton Co., Cleveland, effective March 1, to become vice-president and general manager of the Bigelow Willey Co., Philadelphia, distributor of Paige passenger cars and trucks. Mr. Maltby is now serving for the third term as president of the Automobile Trade Association.

**Mason, of Mason Tire Co., Dead**

CLEVELAND, Feb. 17—Daniel N. Mason, founder of the Mason Tire & Rubber Co., Kent, Ohio, and also one of the founders of the Mason Cotton Fabrics Co., died at his home here Thursday of pneumonia. He was 31 years old and leaves a widow and one child.

**Coe Made Anderson Vice-President**

NEW YORK, Feb. 15—Charles F. Coe has been elected vice-president and general sales manager of the Anderson Motor Co., Rock Hill, S. C. Up to within two weeks ago he was manager of the Chevrolet Motor Co. of New England, with headquarters in Boston. He assumes his new duties March 1.

J. Frank Keegan, formerly with Albertson & Co., Sioux City, has joined the Spencer Metal Products Co., Spencer, Ohio, as traveling representative for the Central West.

Lt. Fred M. Young, who has recently returned from overseas duty in the air service, has become associated with the Perfex Radiator Co., Racine, as sales engineer.

G. W. Williams, Jr., has resigned from the Bureau of Aircraft Production to take over the duties of advertising manager of the United Motor Service, Inc. Before entering Government service eighteen months ago he was with the advertising department of the Electric Storage Battery Co., Philadelphia, for seven years.

Harry E. Weiner has been appointed retail sales manager of the New York branch of the Maxwell Motor Sales Co. He will handle both Chalmers and Maxwell lines.

E. W. Kruste, formerly with the Four-Wheel Drive Auto Co., has been appointed a district representative of the Standard Motor Truck Co., Detroit. His territory includes Wisconsin and Minnesota.

**Maus Made Chairman of Foreign Trade Division**

CHICOPEE FALLS, MASS., Feb. 17—John B. Maus, export manager of the Fisk Rubber Co., has been appointed chairman of the Foreign Trade Division of the Springfield Associated Interests, an association working for the better interests of foreign trade.

**Four Old Employees Return to Pennsylvania Rubber Co.**

JEANNETTE, PA., Feb. 19—Four employees of the Pennsylvania Rubber Co., who have recently been discharged from service, have returned to their former positions. Lieut. George Blair, who has been in the Naval Aviation for the past 18 months, has resumed his position as manager of the Philadelphia branch. P. F. Armitage, in the Naval Reserve Force for the last year, has again taken up the northeastern Pennsylvania territory, with headquarters at the Philadelphia office. Milton H. Batz, who was with the company for eight years until he went into the army eight months ago, is now back on his territory in western New York State, and William E. Little, who for the past six months has been with the Motor Instruction Division, is back on his territory in central Pennsylvania.

**Harley-Davidson to Expand**

MILWAUKEE, Feb. 17.—Enlargement of the plant of the Harley-Davidson Motor Co. is forecast by the fact that the company has engaged the Federal Engineering Co., Milwaukee, to make sketches and estimates of a proposed five-story addition, 50 x 150, at Thirty-eighth and Chestnut Streets to cost about \$100,000.

**National Tire & Rubber Insures Employees**

EAST PALESTINE, O., Feb. 15.—The National Tire & Rubber Co. has presented each of its employees with a life insurance policy paid entirely by the company, and increasing automatically as the employee's term of service increases. It provides for the payment of the full amount of the policy to the beneficiary in case of death of an employee, and in case of permanent disability the full amount of the policy will be paid in monthly installments. The policy may also be transferred and continued by the holder after leaving the employ of the company.

At the present time the addition to the National Tire & Rubber factory is going ahead rapidly, and it plans a greatly increased production next season. It is also bringing out two new brands of tires.

**Pony Tractor New Concern**

LAPORTE, IND., Feb. 18.—Articles of incorporation have been filed by the Pony Tractor Co., with a capital stock of \$100,000. The concern will manufacture, buy and sell, as well as assemble, farm tractors. The promoters are John S. Lingard, George Cummerford and M. E. Leliter, all of this city.

**Mexico as Source of Petroleum and Its Products**

(Continued from page 423)

eral order was issued that no lubricating oil should be thrown away. All the used castor oil in the squadrons was collected in barrels and sent to the Meurisse factory for treatment. In the regenerating process the loss never exceeded 10 per cent. Indeed, the refining factory could frequently work with a loss of only 5 per cent. Although castor oil was the first to be treated in this way, mineral oils were also taken and regenerated in the same way.

Details of the process are not available for publication. The oil is not only filtered but regenerated, and in doing this certain chemicals have to be used. The nature of these chemicals and the method of using them are kept secret. This system, which would never have had an opportunity of coming forth in any but a war period, has been responsible for economizing an immense quantity of oil. Previous to its adoption oil was merely filtered, and then used for some inferior purpose. The Meurisse system appears to be the only one allowing used oil to take the place of new.

**Current News of Factories**

Notes of New Plants—Old Ones Enlarged

**France Prohibits Auto Imports**  
(Continued from page 439)

in francs, paid in France, of a sum of 8,437,500 francs, being the cost to the Government of the said vehicles paid in dollars in America.

6—Receipt by the Government by way of net profit on the transaction of a sum of 843,750 francs.

7—It is estimated that French automobile dealers established in France would make a gross profit from the sale and distribution of these automobiles of a sum of 5,850,000 francs.

8—Continuous employment would be secured for a very large number of demobilized soldiers.

9—The Ford company estimates that its costs for wages of assembly and other expenses for completing these automobiles and distributing them to dealers would amount to a sum of about 4,000,000 francs.

The Ford company claims that the refusal of the Minister of Industrial Reconstruction to allow these automobiles to go into service is resulting in:

1—A loss to the French nation of the utility of 4500 automobiles available in private ownership for immediate service in war devastated areas.

2—A loss of recovery of capital and revenue to the French Government of over 18 million francs.

3—Loss of immediate employment to many hundreds of demobilized soldiers.

4—Suspension of the resumption of commercial business, upon which the prosperity of the French people is dependent.

5—Sacrifice of the good will and commercial friendship of American allies.

The campaign of the Ford company is unprecedented; but it had to be admitted that foreign dealers established in France have been provoked by the uncompromising attitude of French manufacturers, who have used every weapon in order to shut out and discredit the foreigners. It is thought that after this attack by the Ford company the French Government cannot long delay in giving a decision. One important importer of foreign cars maintains that the greatest injustice is not the present prohibition, or the 70 per cent tax, but the continued uncertainty. Establishments have to be maintained in view of the possibility of business at some later date, but at present nobody knows whether these business relations can be re-established in a few weeks or in a few years.

French automobile manufacturers want substantial protection for one year, and after that reciprocity with a maximum import duty of 10 per cent; by this they

**Ajax Profits Less This Year**

NEW YORK, Feb. 15.—The Ajax Rubber Co., Inc., showed an increase in its income for the year of \$960,075 over last year, but a decrease in \$266,225 in its profits after the necessary deductions for taxes, dividends, etc., were made. The balance sheet for the year ending Dec. 31, 1918, as compared with that ending Dec. 31, 1917, follows:

Income Account		
	1918	1917
Profits .....	\$2,915,368	\$1,955,293
Provision for Federal war profits and income taxes .....	1,700,000	495,000
Net income .....	\$1,215,368	\$1,460,293
Dividends .....	852,000	830,700
Surplus .....	\$363,368	\$629,593
Previous surplus .....	768,840	139,247
Total surplus .....	\$1,132,208	\$768,840
Assets		
Land, buildings, machinery, etc., less depreciation .....	\$2,142,536	\$1,862,605
Other property .....	17,410	.....
Patents, good will, etc. ....	1,874,875	1,874,875
Inventories .....	3,917,368	5,424,827
Accounts receivable .....	2,165,420	2,234,585
Liberty bonds .....	477,838	148,000
Cash in banks and on hand .....	363,613	257,341
Deferred charges .....	112,571	118,213
Total .....	\$11,071,634	\$11,920,449
Liabilities		
Capital stock .....	\$7,100,000	\$7,100,000
Accounts payable .....	832,801	3,401,493
Taxes payable (Wisconsin) .....	75,734	.....
Bonuses payable .....	230,889	155,114
War profits and income taxes (estimated) .....	1,700,000	495,000
Surplus .....	1,132,208	768,840
Total .....	\$11,071,634	\$11,920,449

At the directors' meeting, F. E. Dayton, formerly secretary, was elected vice-president. W. J. Jackson succeeds Mr. Dayton as secretary. Otherwise there was no change in the officers or board of directors.

mean that they would admit, for instance, American automobiles free of duty or with any duty not exceeding 10 per cent, providing that America did the same. They would not be interested, however, in a 30 per cent duty in America which obliged them to impose a 30 per cent duty in France.

This was the statement made to me by Louis Delage, one of the leading French manufacturers, who declared that these views were generally shared by members of the Syndicat of Automobile Manufacturers and had been submitted by them to the French Government. The French manufacturers want protection for one year in order to enable them to get their factories on to a peace basis, and to prevent their market being flooded while they are unable to meet the local demand. Reciprocity is considered to be the most satisfactory solution. It would not work equally well in every case, but, on the whole, the results should be good. A reciprocal 10 per cent duty between France and America would rather be to the advantage of America than to France, for it would allow all the cheaper grades of American cars to be sold in France while only some of the higher class French cars could be sold in America.

## THE AUTOMOBILE

## War Department Claims Board.

The Hon. Benedict Crowell,  
Assistant Secretary of War,  
President.

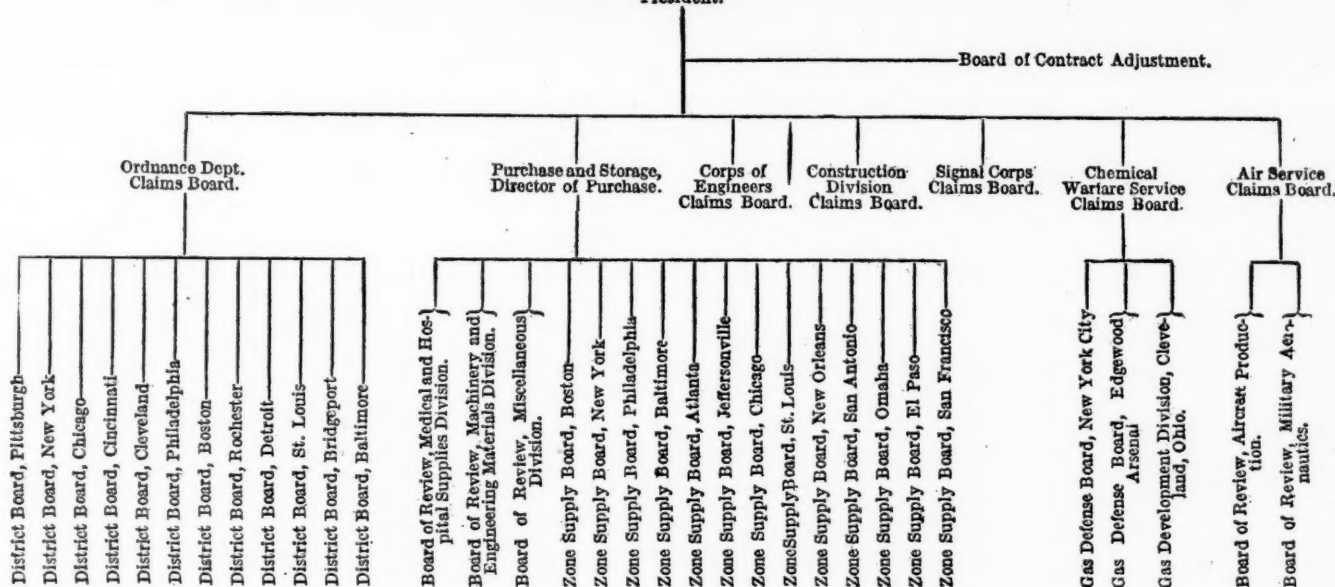


Chart of the organization of the War Department Claims Board

## War Department Claims Board Organized to Adjust and Review War Contracts

WASHINGTON, Feb. 14—The composition of the War Department Claims Board, together with the list of boards supervising and passing upon adjustment of War Department contracts, has been made public by the War Department, and is as follows:

### War Department Claims Board.

President, Hon. Benedict Crowell, the Assistant Secretary of War, director of munitions.

Mr. G. H. Door, assistant director of munitions.  
Brig. Gen. George W. Burr, assistant to Maj. Gen. Goethals, director of purchase, storage and traffic.

Brig. Gen. Herbert M. Lord, director of finance, purchase, storage and traffic division.

Lieut. Col. Herbert H. Lehman, assistant to Maj. Gen. Goethals, director of purchase, storage and traffic.

Special members: Mr. W. H. Davis, Col. C. A. McKenney, Maj. H. L. Goodhart, Maj. Harry D. Rawson, Capt. Arthur Day.

Recorder: Maj. Erskine Bains.

The function of this board is to supervise and co-ordinate the work of contract adjustment throughout the department. Through its special representatives sitting with the bureau boards all contract adjustments of the department are subject to its scrutiny and approval, and adjustments involving matters of policy and of particular difficulty and importance are brought before the full board for decision.

### Board of Contract Adjustment.

Lieut. Col. Herbert H. Lehman, assistant to Maj. Gen. Goethals, director of purchase, storage and traffic.

Lieut. Col. E. F. Malone.  
Lieut. Col. C. B. Garnett.

This board passes on the questions of contract adjustment on which the contractor and the local and bureau boards of the department have been unable to reach agreement.

### Ordnance Bureau.

Ordnance claims board—Brig. Gen. W. S. Peirce, Col. R. P. Lamont, Col. G. H. Stewart, Col. Earl McFarland, Maj. John R. Delafield.

This board reviews the action of the ordnance district boards.

### District Claims Board.

1. Baltimore—Maj. A. V. Barnes, Capt. R. W. Smith, Maj. L. B. Webster, Capt. F. E. Baldwin, Mr. J. J. Nelligan, Mr. E. G. Baetjer.  
2. Bridgeport—Maj. B. A. Franklin, Maj. Frederick Payne, Capt. Miller Brainard, Charles G. Sanford, Edmund C. Wolfe, David H. Day, Charles W. Graham.

3. Boston—Levi H. Greenwood, Lieut. Col. O. S. Lyford, Maj. Herbert S. Brussel, Maj. A. S. Douglass, Mr. Stuart W. Webb, Mr. Charles M. Davenport, Mr. Atherton D. Converse.

4. Chicago—Mr. Edmund A. Russell, Lieut. Col. E. E. Arison, Maj. Frank R. Bacon, Mr. James W. Lyons, Mr. John J. Mitchell, Maj. F. R. Schenck, Mr. George S. Pines.

5. Cincinnati—C. L. Harrison, George S. Raydock, B. W. Lamson, R. K. Leblond, O. De Gray Vanderbilt, Carl M. Jacobs, Stanely G. Rowe, F. H. McClellan.

6. Cleveland—Samuel Scovill, W. B. McAllister, Philip P. Merrill, Amos B. McNairy, Joseph H. Scobell, Judge Thomas H. Strimple, Maj. M. F. Loomis.

7. Detroit—F. J. Robinson, C. C. Huyette, C. C. Jenks, Maj. C. W. Owston, Maj. P. C. Thomas, Henry M. Campbell, Maj. S. L. Depew, Capt. J. G. Dalgleish.

8. New York—Mr. G. J. Roberts, Maj. C. S. Reed, Mr. B. Gold-

smith, Maj. C. C. Smith, Mr. R. A. C. Smith, Lieut. Col. Arthur Adams.

9. Philadelphia—John C. Jones, Capt. Malcolm F. Ewen, Maj. R. M. Appleby, Isaac Hathaway Francis, Maj. F. M. Masters, John Dickey, Jr., Mr. Alexander H. Carver.

10. Pittsburgh—R. M. Drave, Maj. H. B. Scovill, Maj. J. F. Drake, Harrison Nesbitt, George S. Oliver, Charles Gulentz.

11. Rochester—Frank S. Noble, Maj. J. L. Crane, Mr. Langdon A. Bright, Maj. J. J. O'Connell, Mr. Herbert J. Sinn, Joseph W. Taylor, George A. Carnshan.

12. St. Louis—Mr. M. E. Singleton, Maj. E. S. Ready, Maj. B. S. Bope, Mr. W. F. Carter, Mr. C. W. Nelson, Mr. Davis Biggs.

### Office of the Director of Purchase and Storage.

All final contract agreements or settlements are personally approved by Brig. Gen. William H. Rose, Director Purchase.

Board of Review for Termination Agreements handled by the following divisions under the office of the director of purchase: Clothing and Equipage Division, General Supplies Division, Subsistence Division, Remount Division, Motors and Vehicles Division, Raw Materials Division—Col. H. S. Kilbourne, Capt. William E. Lee, Capt. R. D. Stephens.

Board of Review for Medical and Hospital Supplies Division, office of the director of purchase—Lieut. Col. J. F. Fletcher, Capt. J. Van Putten, Jr., Maj. Frank L. McCartney, Maj. G. W. Wallerich, Capt. Harry G. Gunther, Capt. John C. Schweiger.

Board of Review for Machinery and Engineering Materials Division, office of the director of purchase—Col. Earl Wheeler, Lieut. Col. J. E. Long, Maj. George A. Bentley, Maj. Ira D. Hough, Maj. H. W. Eels, Maj. C. B. Loomis, Maj. H. McC. Yost, Capt. B. H. Arnold.

### Zone Board of Review.

Atlanta, Ga., Transportation Building—Maj. G. M. Alden, Quartermaster Corps, Maj. L. M. Thibadeau, Quartermaster Corps; Maj. E. de T. Ellis, Infantry; Capt. J. A. Graham, Quartermaster Corps.

Boston, Mass., 108 Massachusetts Avenue—Maj. J. W. Blunt, Quartermaster Corps; Maj. W. H. Rhoads, Quartermaster Corps; Capt. Leroy Holder, Quartermaster Corps; First Lieut. A. A. Lucey, Quartermaster Corps; Mr. George E. Barnard.

El Paso, Tex.—Capt. F. C. Allen, Quartermaster Corps; Capt. F. C. Shelley, Quartermaster Corps; Mr. W. H. Dent.

Jeffersonville, Ind., Meigs Avenue—Maj. M. T. Levey, Quartermaster Corps; Maj. L. L. Sims, Quartermaster Corps; First Lieut. Henry Pirtle, Quartermaster Corps; First Lieut. L. C. Clarke, Quartermaster Corps.

New Orleans, La., Audubon Building—Maj. P. T. Murphy, Quartermaster Corps; Maj. E. I. Sharp, Quartermaster Corps; Capt. F. L. Hester, Quartermaster Corps; Second Lieut. S. Roccaforte, Quartermaster Corps; Mr. Benjamin Coswell Cassenas.

Omaha, Neb., Army Building—Maj. William H. Faringly, Quartermaster Corps; Lieut. Col. P. H. Holcombe, Quartermaster Corps; First Lieut. George E. Comins, Quartermaster Corps; Mr. C. E. Adams, Inspector, Quartermaster Corps; Mr. Fred S. Knapp.

Philadelphia, Pa., Twenty-first and Oregon Avenue—Maj. Remi Hueper, Quartermaster Corps; Maj. Archibald H. Bronson, Quartermaster Corps; Maj. Herbert Knox Smith, Quartermaster Corps; Maj. James M. Taft, Quartermaster Corps; Capt. Otis S. Carroll, Quartermaster Corps.

St. Louis, Mo., Second and Arsenal Streets—Maj. R. Field, United States Army retired; Maj. J. W. Byrnes, Quartermaster Corps; Capt. J. P. Keleher, Quartermaster Corps; Second Lieut. G. Rosenbaum, Quartermaster Corps; Mr. A. J. Davis.

San Antonio, Tex., General Supply Depot—Maj. E. O. Baldwin, Quartermaster Corps; Maj. T. O. Baker, Quartermaster Corps.

# Calendar

## ENGINEERING

### S. A. E. Meetings

- Feb. 27—Kansas City, S. A. E. tractor meeting at Sweetney School Auditorium; dinner at Hotel Baltimore.
- March 5—Minneapolis Section, S. A. E.—Hotel Radisson. "Tractor Service and Sales."
- April 2—Minneapolis Section, S. A. E.—Hotel Radisson. "Implements Designed for Tractor Belt Power and Their Characteristics."

### MOTOR SHOWS

- Feb. 17-22—Louisville, Ky. Louisville Auto Dealers' Assn.
- Feb. 17-22—Des Moines, Iowa. Tenth Annual, Des Moines Automobile Dealers' Assn. C. G. Van Vliet, Manager.
- Feb. 17-22—Pittsfield, Mass. Pittsfield Automobile Dealers' Assn., State Armory. James J. Callahan, Manager.
- Feb. 17-22—Passenger Cars; Feb. 24-27, Trucks—South Bethlehem, Pa. Lehigh Valley Auto Shows Co. J. L. Elliott, Manager.
- Feb. 17-22—Grand Rapids, Mich. Grand Rapids Automobile Business Assn. E. T. Conlon, Manager.
- Feb. 17-22—Seattle, Wash. Cars, Motor Car Dealers' Assn., State Armory. A. G. Schaeffer, Manager.
- Feb. 18-22—Baltimore, Md. Baltimore Automobile Dealers' Assn. and Automobile Club of Maryland, Fifth Regiment Armory. H. M. Lucius, General Manager.
- Feb. 18-22—Oklahoma City, Okla. Automotive Show. R. H. Haun, Manager.
- Feb. 18-22—Wichita, Kan. Wichita Automobile Dealers' Assn.
- Feb. 19-22—Evansville, Ind. Cars, Evansville Automobile Dealers' Assn. Coliseum.
- Feb. 22-March 1—Hartford, Conn. Hartford Automobile Dealers' Assn., Inc., Broad Street Armory. Ben F. Smith, Manager.
- Feb. 22-March 1—Atlantic City, N. J. Auto Trades Assn. of Atlantic City.
- Feb. 22-March 1—New Castle, Pa. Lawrence County Association of Automobile and Accessory Dealers.
- Feb. 22-March 1—Reading, Pa. Reading Auto. Trade Assn.

- Feb. 23-March 1—Cedar Rapids. Auditorium, Automobile Dealers' Assn.
- Feb. 24-March 1—Burlington, Ia. Second Annual.
- Feb. 24-March 1—Kansas City, Mo.—Kansas City Motor Dealers' Assn. E. E. Peake, Manager.
- Feb. 24-March 1—Springfield, Mass. Automobile Dealers' Assn. Harry W. Stacy, Manager.
- Feb. 24-March 1—Springfield, O. Auto. Trade Assn.
- Feb. 24-March 1—Portland, Ore. Ninth Annual Dealers' Motor Car Assn., Automobile Palace. M. O. Wilkins, Manager.
- Feb. 24-March 1—Duluth, Minn. Duluth Automobile Dealers' Assn.
- Feb. 25-March 1—Erie, Pa., United States Garage.
- Feb. 26-March 1—Mason City, Ia. Fifth Annual, Mason City Auto Show Assn.
- Feb. 26-March 1—Madison, Wis. Seventh Annual, Automobile Dealers' Division of Madison Assn. of Commerce, Union Transfer Bldg.
- Feb. 26-March 1—Quincy, Ill. Cars, Quincy Automobile Trade Assn. Armory.
- Feb. —Wheeling, W. Va. Automobile Show at Market Auditorium.
- March 1-15—New York Aeronautical Exhibition, Manufacturers' Aircraft Assn., Madison Square Garden and 69th Regiment Armory.
- March —Scranton, Pa. Thirteenth Regiment Armory, Scranton Automobile Assn.
- March —Utica, N. Y. Utica Motor Dealers' Assn. W. W. Garabrandt, Manager.
- March —Philadelphia, Pa. Philadelphia Automobile Trade Assn. Passenger cars.
- March 1-8—Detroit, Mich. Detroit Automobile Dealers' Assn. H. H. Shuart, Manager.
- March 3-5—Quincy, Ill. Trucks and Tractors. Armory.
- March 3-8—Muskegon, Mich. Third Annual, Armory, Muskegon Lodge No. 274. B. P. O. E. John C. Fowler and George M. Friant, Managers.
- March 3-8—Columbus, O. Columbus Automobile Show Co., Memorial Building. W. W. Freeman, Manager.
- March 3-8—Scranton, Pa. Ninth Annual, 13th Regiment Armory, Scranton Automobile Assn. Hugh B. Andrews, Manager.

- March 3-8—Buffalo, N. Y. Buffalo Automobile Dealers' Assn.
- March 5-8—Lancaster, Pa. Automobile Trade Assn., Rowe Motor Co.'s Bldg. R. W. Shreiner, Manager.
- March 8-15—New Brunswick, N. J. Armory, New Brunswick Motor Trade Assn. William Kuehle, Manager.
- March 8-15—Philadelphia, Pa. Philadelphia Automobile Trade Assn., Commercial Museum. A. L. Maltby, Manager.
- March 10-15—Paterson, N. J. Paterson Automobile Trade Assn., Fifth Regiment Armory. H. MacGinley, Show Manager.
- March 10-15—Syracuse, N. Y. Syracuse Automobile Dealers' Assn. Harry T. Gradner, Manager.
- March 10-15—Omaha, Neb. Fourteenth Annual, Omaha Automobile Trade Assn., Auditorium. Clark G. Powell, Manager.
- March 12-18—Peoria, Ill. Passenger cars, 12 to 15; trucks, 17 and 18.
- March 15-22—Boston, Mass. Boston Automobile Dealers' Assn. Passenger cars only. Chester I. Campbell, Manager.
- March 15-22—Harrisburg, Pa. Harrisburg Motor Dealers' Assn., Overland Warehouse. J. Clyde Myton, Manager.
- March 17-22—Great Falls, Mont. Montana Automobile Distributors' Assn.
- March 17-22—Philadelphia, Pa. Motor Truck Assn., Commercial Museum.
- March 19-22—St. Joseph, Mo. St. Joseph Automobile Show Assn., Auditorium. John Albus, Manager.
- March 19-22—Norfolk, Neb. Norfolk Automobile Show Assn.
- March 22-29—Pittsburgh Automobile Dealers' Assn. of Pittsburgh. John J. Bell, Manager.
- March 22-29—Passenger Cars. April 1-5—Trucks, Brooklyn. Brooklyn Motor Vehicle Dealers' Assn. I. C. Kirkman, Manager.
- March 24-29—New Orleans, La. Henry B. Marks, Manager.
- March 24-29—Greenfield, Mass. Greenfield Automobile Dealers' Assn., State Armory. James J. Callahan (Pittsfield) Manager.

- March 24-29—Utica, N. Y. Utica Motor Dealers' Assn.
- March 26-29—Watertown, N. Y. Tenth Annual, State Armory, Automobile Dealers, Inc. Arthur E. Sherwood, Manager.
- Third week March—Trenton, N. J. Trenton Auto Trade Assn. John L. Brock, Manager.
- April 5-12—Bridgeton, N. J. Fourth Annual, Automobile Dealers' Assn.
- April 5-12—Montreal, Can.—National Motor Show of Eastern Canada, Victoria Rink. T. C. Kirby, Manager.
- April 13-19—Bristol, Tenn. Cars, trucks, tractors, airplanes and accessories. Bristol Chamber of Commerce.
- Not decided—Bridgeport, Conn. Auspices of City Battalion. B. B. Steiber, Manager.
- Not decided—Indianapolis, Ind. Indianapolis Auto Trade Assn. John B. Orman, Manager.
- June 2-6—Hot Springs, Va. Convention, Automotive Equipment Assn., Homestead Hotel.

### TRACTOR SHOWS

- Feb. 15-22—Minneapolis, Minn.
- Feb. 18-22—Wichita, Kan. Annual Mid-west Tractor and Thresher Show. Wichita Tractor and Threshing Club. Forum.
- Feb. 24-March 1—Kansas City, Mo. Fourth Annual Tractor Show. Sweetney Building, Kansas City Tractor Club. Guy H. Hall, Sec.

### RACES

- March 15—Santa Monica, Cal. Speedway.
- May 17—Uniontown, Pa., probably 112½ miles.
- July 5—Cincinnati, O., Speedway.

### CONVENTIONS

- Feb. 25-28—New York. Sixteenth Annual Convention. American Road Builders' Assn.
- Feb. 25-28—Ninth American Good Roads Congress and 16th Annual Convention of the American Road Builders' Assn. Hotel McAlpin, New York.
- April 10-12—Philadelphia. National Assn. of Motor Truck Sales Mgrs., Bellevue-Stratford.
- April 24-26—Chicago—National Foreign Trade Council Sixth National Foreign Trade Convention. Congress Hotel.

Capt. E. N. Purvis, Quartermaster Corps; First Lieut. E. A. Mechling, Quartermaster Corps; Mr. Ray Mackey.

Chicago, Ill., 1819 West Thirty-ninth Street—Col. Roy B. Harper, Cavalry; Capt. J. M. Griffith, Quartermaster Corps; Capt. John A. Russian, Quartermaster Corps; Mr. Frederick C. Hack; Maj. E. J. Zimmerman, Quartermaster Corps; Maj. E. H. Caswell, Quartermaster Corps; Maj. George F. Mayer, Quartermaster Corps; Capt. J. C. Shugert, Quartermaster Corps; Capt. H. M. Rodgers, Quartermaster Corps; Capt. E. A. Hey, Quartermaster Corps; Capt. Edward Rosing, Quartermaster Corps; Capt. George H. Bussman, Quartermaster Corps.

San Francisco, Cal., Fort Mason—Maj. Gen. C. A. Devol, United States Army; Col. Charles A. Varnum, United States Army, retired; Mr. Clay Miller.

San Francisco, Cal.—Mr. William Thomas; Mr. Milton H. Ebert; Baltimore, Md.—Maj. D. W. O'Neill; Maj. J. L. Beatie; Capt. S. T. Griffith.

New York, N. Y.—Lieut. Col. Benjamin L. Jacobson, Maj. Joseph E. Lee, Quartermaster Corps; Mr. William R. Collins; Mr. John H. Love; Mr. Henry Itleson; Second Lieut. William C. Lovett, Quartermaster Corps.

Washington, D. C., Seventeenth and F Streets N.W.—Capt. W. J. Schaefer, Quartermaster Corps; Maj. H. A. Barnard, Quartermaster Corps; Capt. C. F. Young, Quartermaster Corps; Capt. R. A. Burbank, Quartermaster Corps; Mr. Ben J. Miller.

### Signal Corps.

Board of Contract Review—Lieut. Col. R. H. Morse, Maj. R. A.

Klock, Maj. J. R. Whitehead, Capt. Lawrence Thompson, Capt. S. M. Conant, Capt. W. S. Kelly, Capt. Milhau.

### Chemical Warfare Service.

Board of Review—Maj. Gen. W. L. Sibert, Col. N. T. Bogart, Maj. C. C. Combs, Capt. William K. Jackson, Capt. H. S. Brown.

Board of Review, Gas Defense, New York City—Col. Besse, Maj. Schuit, Capt. Kay, Lieut. Mitchell.

Board of Review, Gas Offense Edgewood Arsenal—Col. William H. Walker, Maj. E. E. Free, Capt. R. D. Gordon.

Board of Review, Gas Development Division, Cleveland—Col. Dorsey.

### Air Service.

Board of Review of the Bureau of Aircraft Production—Lieut. Col. A. C. Downey, Lieut. Col. H. S. Brown, Lieut. Col. F. E. Smith, Capt. F. B. Schnacke, Capt. S. M. Wiley.

Board of Contract Review of Division of Military Aeronautics—Lieut. Col. Harold Bennington, Maj. Edw. Burns, Maj. W. G. Roberts, Capt. Otis Van der Mark, Capt. William G. Dean.

### Engineer Corps.

Board of Contract Review—Maj. C. M. Goodrich, Capt. H. L. Beach, Capt. M. B. Keefer, Capt. J. B. Hall, Capt. Grove Ketchum.

### Construction Division.

Board of Review—Col. J. N. Willcut, Lieut. Col. J. N. Pease, Lieut. Col. H. F. Durant, Lieut. Col. L. L. Calvert, Maj. H. J. Burke, Maj. C. F. Neff, Maj. L. G. Kelly, Capt. C. N. Foster, Capt. William B. F. Manice, Capt. J. B. Hudgins.